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THE INTERNATIONAL SCIENTIFIC SERIES

ANTHROPOID APES

BY

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Professor in the University of Berlin

With Sixty-three Illustrations

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ANTHROPOID APES.

CHAPTER I.

THE DEVELOPMENT OF OUR ACQUAINTANCE WITH ANTHROPOID APES.*

OUR first acquaintance with the great anthropoid apes dates from the times of remote antiquity. The West Coast of Africa, which is the abode of these animals, was known to the Carthaginians as early as B.C. 500. In B.C. 470 Hanno set out with sixty fifty-oared galleys, laden with colonists and merchandise, on a grand expedition across Morocco to Upper Guinea. The object in view was partly mercantile, partly undertaken with the purpose of establishing a colony. It seems that at that time pioneering expeditions had previously taught them how far the coast was adapted for colonization. The Carthaginians met with "*gorillai*" on the lower range of the mountains of the Isle of Sherboro,

* A list of the numerous authorities for the substance of this chapter is placed at the end of the volume.

and in the mountainous district of Sierra Leone (1). These are described as hairy sylvan creatures who replied to the attacks of the seafarers by throwing stones at them. Three of these monsters, of the female sex, were captured, but they bit and scratched so furiously that it was necessary to kill them on the spot. Pliny relates that at the time of the Roman invasion, B.C. 146, two of the skins obtained on this occasion were still preserved at Carthage, in the temple of Astarte (2). It was subsequently shown that chimpanzees, not true gorillas, were described in these "gorillai." The latter animals are not now found so far north.

An old representation of the chimpanzee, in mosaic, was found on the pavement of the temple of Fortuna at Præneste (now Palestrina). This mosaic is now in a museum at Rome, and has been described by several authors. It represents a scene in tropical Africa, probably on the Upper Nile. I find it difficult to recognize the chimpanzee on the mosaic amid the giraffes, hippopotami, crocodiles, and the other representatives of the animal world of tropical Africa (3). But it is well known that these large apes are found on some of the streams of the Upper Nile, as in Niam-Niam and Uganda. Pliny writes of these animals: "On the Indian mountains to the south, in the land of the Catharcludi, there are satyrs. These are the swiftest of creatures, sometimes going on all fours, sometimes upright like men, and they are so active that they can only be captured when old or sick" (4). These satyrs have been identified with the orang-utan, but the gibbon

may also be intended, which is swifter and more agile, when in an upright position, than the orang-utan.

Subsequent to the remote period which we have cited, there is a long silence respecting these remarkable animals. Only at the time when Portugal became subject to the power of Spain, we hear something about them from Congo and Angola. The sailor Eduardo Lopez gave an account of the chimpanzee, which was published by Pigafetta in 1598 (5). There are later accounts of very large apes in the writings of Pedro da Cintra (6), Father Merolla of Sorrento (7), Froger (8), and William Smith (9).

Smith gives a representation of the chimpanzee under the erroneous name of the mandril (Cynocephalus maimon). The illustration is bad, but it may be recognized by his discription. In 1641 the Dutch anatomist N. van Tulpe (Tulpius) gave a better illustration of this anthropoid (10). This naturalist observed that the animal in question, Homo sylvestris or orang-utan (Satyrus indicus), is called quojas morrou by the Africans. An anatomical discription of the chimpanzee, which is still of great value, was given by Tyson in 1699 (11). The anatomical illustrations included in this work are remarkably well executed for that time.

Our biological acquaintance with the West African anthropoids is considerably increased by the account given in the sixteenth century by the adventurer Battel, of Leigh, in Essex. This man passed through the forests of Lower Guinea, as

sergeant of the Portuguese troops under the command of the Governor of Angola, Don Manuel Silveira Pereira. In 1613 Battel's account was published by his neighbour Purchas in his Pilgrims (12). Battel speaks of two kinds of large apes, the engeco and the pongo, which inhabited the forest on the banks of the Banna and the Mayombe. The engeco corresponds to the ndjéko or nschégo (chimpanzee), the pongo to the n'pungu of Loango, or the gorilla. Battel's discription of the habits of these animals affords some characteristic touches which will concern us presently. We may date our earliest acquaintance with the largest of all the anthropoids from this adventurer's career.

The Dutch physician Oliver Dapper published in 1668 a detailed description of Africa (13), in which there is much of value, and he mentions the large apes, called quojos morrau or morrou, which inhabit the kingdom of Congo (14). By these he apparently means the chimpanzee.

Some account, unfortunately rather vague, of the gorilla has been recently given by Bowdich in his very interesting work on the "Mission of the Anglo-African Company to Ashanti" (15). He says that there are several remarkable species of apes in the territory of the Gaboon, among which the ingena (gorilla) is the strangest. The natives asserted that this animal is much larger than the orang-utan, generally five feet tall, and four feet broad from shoulder to shoulder.

In 1847 Dr. Savage, a Protestant missionary on the Gaboon, reported to the distinguished anatomist Owen that there was an ape in that country larger than the chimpanzee. In addition to this information, he sent some drawings of skulls by the wife of an English missionary, Prince, in which the supra-orbital arch is strongly developed. Savage gave to the animal the name of Troglodytes Gorilla, to distinguish it from Troglodytes niger, the chimpanzee. Owen also described two skull of gorillas, sent to him from the Gaboon (16). The skull of a Gorilla, sent to Boston by the missionary Wilson, was drawn and described by Professor Jeffreys Wyman, and with it the notes of the donor were also published (17). In 1851 the skeleton of a gorilla reached Philadelphia through the medical missionary H. A. Ford, who also published the latest accounts of the new anthropoid (18). In 1849 some remains of a gorilla reached Paris through Gautier Laboulaye, and this valuable contribution to natural history was received by de Blanville and Isidore Geoffroy Saint-Hilaire. In 1851 and 1852 more perfect remains were presented to the Museum in Paris by Dr. Franquet and Admiral Penaud. In the finely illustrated works by de Blainville (19), Is. Geoffroy Saint-Hilaire (20), and Duvernoy (21), there are represented with great care. A splendid illustration of one of these specimens, excellently stuffed, consisting of an adult male, adorns the Photographie zoologique, by L. Rousseau and A. Devéria, which has, so far as I am aware, been published without any text (22).

This illustration is so true to nature that I made use of it in one of my earlier publications (23).

Paul Belloni du Chaillu, born in North America of French parents, and reared in his father's merchantile house on the Gaboon, spent the years 1855-65 in roaming through the lands bordering on the Gaboon, the Ogōwē, and the Fernão Vaz; he professed to have taken part in gorilla-hunts, and he published several books about his travels (24). Critical light has been thrown upon these works, especially by A. E. Brhem and Winwood (25); the illustrations are defective, and the text is full of tales of adventure. Du Chaillu's information respecting the African anthropoids was published in the Proceedings of the Zoological Society of London (26). His remarkable collection of the remains of apes has been described by Jeffreys Wyman (27), to whom we are also indebted for a notice of the materials collected by Savage (17).

Owen has published instructive anatomical treatises on the gorilla and the chimpanzee, in addition to those already cited. This English professor had the opportunity of dissecting a young male gorilla, imperfectly preserved in spirits of wine (28). The travellers Burton (29), de Compiègne (30), Savongnan de Brazza (31), Lenz (32), the members of the German-African Loango Expedition (33), and Von Koppenfels (34) have also contributed some information respecting the Gorilla in a wild state. Other works on the Zoology and anatomy of this animal have been published by Duvernoy, already cited, Dahlborn (35), Haeckel (36), Flower (37), Ipsel (38), Giglioli (39), Chapman (40), Mivart (41), Macalister (41 A), Von Aeby (42), Lucae (43), Ecker (44),

Bolau (45), Pansch (46), Lenz (47), A. B. Meyer (48), R. Meyer (49), Bischoff (50), Ehlers (51), Virchow (52), Von Bär (53), by the author of this work (54), etc. Duvernoy, Chapman, Bischoff, Bolau, Ehlers, and I have, like Owen, been able to dissect perfect specimens of the gorilla. Two of the specimens which came into my hands were unquestionably in the best condition, since I obtained them immediately after their deaths in Berlin. A larger specimen of a female, 1000 mm. tall, was in worse preservation, yet still quite available for the purposes of study.

The list of anatomical treatises on the gorilla is not yet exhausted. Valuable information may be found in the anthropological works by C. Vogt (55), in the writings of Pruner-Bey (56), and Magitot (57), in Darwin's works (58), in *Histoire Naturelle des Mammifères*, by Gervais (59), in Huxley's *Anatomy of Vertebrated Animals* (60), in Flower's *Osteology of the Mammalia* (61), in Giebel's *Odontographie* (62), and in many other handbooks and treatises on natural history, which want of room forbids me to mention.

In 1860, so far as I am aware, the first living gorilla reached England. It survived its arrival seven months, and a good illustration of this creature, accompanied by a brief description, has been recently published in the *Proceedings of the Zoological Society of London* (63). In 1876, towards the end of June, Dr. Falckenstein brought the second living gorilla from Loango to Berlin. It had been kept in confinement in that country at the German station Chinchoxo since 1874, and

it died on November 13, 1877, at the Berlin Aquarium. Dr. Hermes obtained a third specimen in September, 1881, which died soon after its arrival in Berlin. In 1883 a fourth still survived in the Berlin Aquarium.

The chimpanzee became the more general object of zoological and anatomical study at an earlier period, since the species occupied a wider area than the gorilla, and is more easily captured. I have already mentioned Hanno's observations on the subject, and the animal described by von Tulpe. In 1740 Buffon had seen a young specimen of the chimpanzee, and another was in existence in London at the same time. In vol. 35, pl. 2, of his Natural History, Buffon gives an illustration of the chimpanzee, and pl. 3 represents an orang-utan, not very true to nature, but still recognizable (64). It is commonly supposed that the Dutch traveller Bosman, cited by Buffon, was acquainted both with the gorilla and the chimpanzee. He speaks of an ape about five feet high, living near Fort Wimba "d'une couleur fauve" (65). Although Buffon was acquainted with the names chimpanzee and chimpezée, as well as with Battel's surmises about the pongo and the enjeco, yet he regarded the jockos, pongos, and orangs as animals all belonging to one species. The young African animals observed by him and von Tulpe (chimpanses) must have been young pongos (66). The name pongo was afterwards applied to the old misshapen orang-utan. The skin and skeleton of the chimpanzee observed by Buffon when still alive, was preserved in the Zoological

museum in Paris as late as 1842 (67). There is a beautiful illustration of a young female which lived in the menagerie of the Jardin des Plantes in Paris in 1838 in the catalogue of this noble institution (68). This illustration, in which the animal is represented on all fours, has since been frequently copied. Copies have also been made of the drawings of the same individual in a walking position, and swinging by one arm, which originally appeared in Velins' famous catalogue of the Museum of Paris. Is. Geoffroy Saint-Hilaire and Dahlbom have given good illustrations of the head and body of an old male chimpanzee (69). Numerous, and for the most part correct, pictures of the chimpanzee have been given in several modern works and illustrated papers (70). Undoubtedly the best representations of the chimpanzee, corrected from photographs taken from life, are found in my osteological treatise on the Gorilla which appeared in 1880, and also in the little book which preceded it (71). The form and mode of life of this species of ape are fairly well described by Bischoff (72), as well as in the books already mentioned, and especially in those by Temminck (73), Gervais, Reichenbach, and Brehm. Recently the opportunities of describing the bodies of chimpanzees have been frequent. Remarks on the anatomy of this animal may also be found in the works of Tyson (11), Vrolik (74), Champneys (75), Brühl (76), and Schroeder van der Kolk and Vrolik (77), as well as in the works we have already mentioned by Owen, Duvernoy, Bischoff, Issel, Giglioli, Lenz, etc.

Du Chaillu (26), Duvernoy (78),

Bischoff (50), Gratiolet and Alix (79), A. B. Meyer (80), and the author of this work (81) have treated of the external form and internal structure of species of apes, and varieties of the chimpanzee.

Much has been written about the orang-utan since Vosmaer's (82) day, among others by Rademacher (83), Wurmb (84), Griffith (85), Temminck (86), Schlegel and S. Müller (87), Is. Geoffroy Saint-Hilaire (88), Brooke (89), Abel (90), and Wallace (91). Camper (92), Owen (93), J. Müller (94), Schlegel and S. Müller (95), Heusinger (96), Dumortier (97), Brühl (98), Bischoff, Langer (99), etc., have studied the anatomy of this animal. Good illustrations of the orang-utan are found in Vélins catalogue, copied by Chenu (100) and Gervais (101), and in Wallace; also in the designs by Mützel (102) and Max (103), and in my work on the Gorilla, already cited.

It had been already shown by Tilesius (104) and Cuvier (105) that Wurmb's young pongo is identical with the orang of Linnaeus. We now know certainly that the name pongo (n'pungu in Loango) should only be applied to the gorilla.

The fourth and smallest species of anthropoid apes, the Indian long-armed apes or gibbons, have been recently described, with reference to their form and mode of life, by various travellers and naturalists, especially by Duvaucel (106), Bennet (107), Martin (108), Lewis (109), S. Müller (110), Diard (111); also by Buffon (112), Is. Geoffroy Saint-Hilaire (113), and Blyth (114), etc. Gulliver (115), Bischoff (116), and the author of this work have studied the anatomy of these creatures

Chapter II.

The external form of anthropoid apes.

In the gorilla, the chimpanzee, and the orang-utan the external form is subject to essential modifications, according to the age and sex. The difference between the sexes is most strongly marked in the gorilla and these differences are least apparent in the gibbon.

When a young male gorilla is compared with an aged animal of the same species, we are almost tempted to believe that we have to do with two entirely different creatures. While the young male still displays an evident approximation to the human structure, and develops in its bodily habits the same qualities which generally characterize the short-tailed apes of the Old World, with the exception of the baboon, the aged male is otherwise formed. In the latter case the points of resemblance to the human type are far fewer; the aged animal has become a gigantic ape, retaining indeed in the structure of his hands and ~~feet~~ the characteristics of the primates, while the protruding head is something between the muzzle of the baboon, the bear,

and the boar. Simultaneously with the remarkable alterations of the external structure there occurs a modification of the skeleton. The skull of an aged male gorilla becomes more prognathous, and the incisor teeth have almost attained the length of those of lions and tigers. In the upper part of the skull, which is rounded in youth, great bony crests are developed on the crown of the head and on the occiput, and these are supported by the high, spinous processes of the cervical vertebrae, and thus supply the starting-point for the powerful muscles of the neck and jaw. The supra-orbital arches are covered with wrinkled skin, and the already savage, and indeed revolting, appearance of the old gorilla is thereby increased. A comparison of the two illustrations (figs 1 and 3) which accompany the text, will make this clear.

These distinctions are not so striking in the female as in the male gorilla. Although there is much which is bestial in the appearance of an aged female, yet the crests, so strongly marked in the male, the projecting orbits, and strong muscular pads are absent in the female, as well as the prognathous form of the skull and the length and thickness of the canine teeth. The aged female gorilla is not, in her whole structure, so far removed from the condition of the same sex in youth as is the aged male. The structure of the female has on the whole more in common with the human form. It has been said, and indeed on good authority, that the female type should take the formost place in the study of the animal structure, since it is the more universal.

But H. von Nathusius maintains that we must take both sexes into consideration in the study of domestic animals, since both are needed to determine the breed.* I accept this condition in the scientific study and description of wild animals also, of every kind and species. All that is said of the universal type of the female animal is and must remain in my eyes a mere phrase. Only the accurate observation of males and females, and of young individuals of both sexes, can throw sufficient light on the history of the race. The male animal is the larger, and predominant with respect to the complete development of certain peculiarities of form in the specific organism, since these are doubtfully present in the adult female, and are either altogether absent in the immature young, or only rudimentary.

Let us now consider, in the first place, the prototype of the species, the aged male gorilla in the full strength of his bodily development (Fig. 1). This animal, when standing upright, is more than six feet in height, or 2000 mm. The head is 300 mm. in length. The occiput appears to be broader below than above, since the upper part slopes like a gabled roof towards the high, longitudinal crest of the vertex. The projecting supraorbital arches start prominently from the upper and central contour of the skull. In this species, as in other apes, and indeed among mammals generally, and especially in the case of the carnivora, ruminants, and multi-ungulates, eyebrows

* *Vorträge über Viehzucht und Rassenkenntniss*, i. 61: Berlin, 1872.

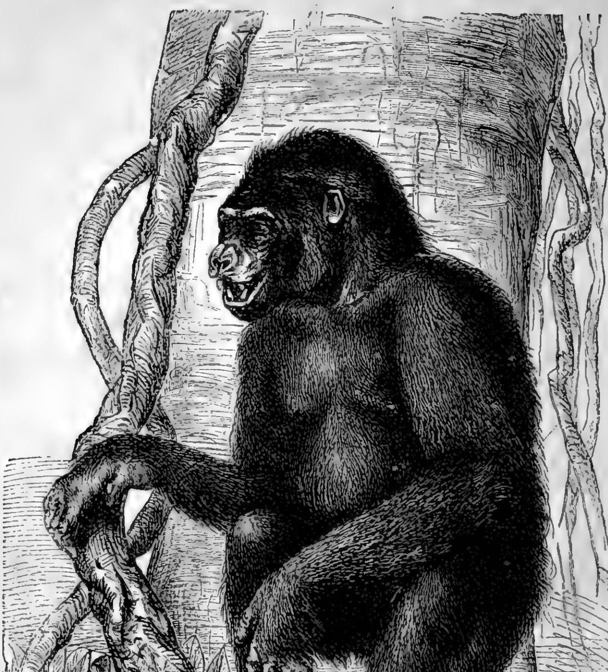

Fig. 1.—Aged male gorilla.

are present. In the gorilla these consist of a rather scanty growth of coal-black bristles, about 40 mm. in length. Beneath the projecting supra-orbital arches are the eyes, opening with somewhat narrow slits, and with lids which display many and deep longitudinal folds. The upper lid is set with longer and thicker eyelashes than the lower. The dark eyes glow between the lids with a ferocious expression.

The bridge of the nose rises gradually outwards from between the inner corners of the eyes, and is keel-shaped in the centre. This part of the head is from 70 to 80 mm. in length, longer and narrower in one individual, shorter and wider in another. The skin in this region is covered with a network of wrinkles of varying size. The end of the nose and the nostrils are high, conical, and very wide at the base. This part of the nose, attached to the very projecting forehead, has the effect of an altogether snout-like muzzle. It is intersected by a central longitudinal furrow, which divides the whole tip of the nose into two symmetrical halves. This furrow is more strongly marked in the case of adult animals than in the young. The aperture of the nostrils is large and triangular, with the cartilaginous point turned upwards, and the edges applied to the bridge of the nose and to the cheeks have a somewhat retreating appearance. The lateral margins of this part of the nostril take an arched form, first diverging in different directions, then gradually converging again towards the upper lip. The lip is short, and this, combined with the large nose, gives a certain resemblance to the mouth of

an ox. This resemblance is the more striking, as the whole of this region is covered with glandular skin of a deep black colour, which is either glabrous or provided with a few scattered hairs, but furnished with small flattened warts.

Below the eyes the cheeks are broad and very round, dwindling away and becoming depressed in the lower part of the face. They are seamed with curved wrinkles of varying depth, which tend downwards in the same direction as the wrinkles on the lower eyelids. The short upper lip is provided with oblique folds which converge outwards in the centre. The points of the strong canine teeth, which in many individuals are from 38 to 40 mm. long, and 20 mm. wide, diverge a little from each other, and stretch the upper lip in an oblique direction, so that this part of the face takes the form of a triangular, bevelled surface, with its prominent base-line between the canine teeth. It may also be observed that in many individuals of this species the nose is not very deeply set on the upper lip; that in others, again, the nose is decidedly raised, and the lip only presents a small hem below the nose. In many such cases the prognathism of the face is strongly marked, so as to give a baboon-like effect. In other specimens, again, this debased type is not allied with strongly marked prognathism.

If we take a front view of the skull of an aged male gorilla we see that the upper edges of the great supra-orbital arches are bevelled off below and at the sides. This bevelled form is repeated in the broad cheek-bones, as we see them in front. The front

view of the head, and indeed of the whole animal, presents a strongly projecting contour, an impression which is strengthened by the puffed cheeks, with their lateral pads of fat. The lower jaw, with its scarcely indicated chin, retreats in the centre and dwindles into a triangular form. This contour is characteristic of the species. The whole skin of the face is glossy, set with few hairs, and of a deep black colour.

Fig. 2.—Ear of a male adult gorilla.

The ear (Fig. 2) averages 60 mm. in length, and from 36 to 40 mm. in width. It seems to be fastened to the head by the back and upper part, is generally of an oval shape, and furnished with a strongly marked helix. The helix varies in width in different individuals, and often terminates on its inner edge in the projecting peaked excrescence described by Darwin, of which I shall have more to say presently. The anti-helix, tragus, and anti-tragus, and the cleft

which lies between these two latter parts (*incisura inter tragica*) are generally fully developed; the lobule is more rarely present. Individual variations in the special structure of these parts may frequently be observed.

The strong trapezoid muscles are prominent on the neck, and when the head is stretched they stand out like pillars on the sides of the neck. Owing to the great development of the spinous processes of the cervical vertebræ and of the muscles attached to them, and to the occipital bones of the skull, the neck is very powerful, almost like that of a bull. The shoulders are remarkable for their breadth, and the pectoral muscles for their large size. The nipples of the breast, which are not surrounded by any visible *areolæ*, stand out in youth, and afterwards assume a horny texture which stiffens into a kind of bone. When one of these animals is gorged with food the navel is still apparent on the tun-shaped, rounded belly, of which the sides fall in when the stomach is empty.

On the upper and forearms the plastic form of the strongly developed flexor and extensor muscles is very apparent, testifying to the enormous strength of the upper extremities. The hands are large, and very wide, with short, thick fingers. The thumb, of which the extremity takes a conical form, is short, extending little beyond the middle of the second metacarpal bone. The extremities of the otherwise broad fingers are somewhat laterally compressed. The fore-finger is not materially shorter than the middle finger. The third finger is sometimes shorter

than, sometimes of the same length as, the first, and the fourth is decidedly shorter. The back of the wrist is covered with deep oblique folds. A network of wrinkles, oblique or curved, also covers the skin on the back of the fingers, on which there are callosities up to the first joint. The gorilla closes the fingers when going on all fours, and turns the back of the hand on the ground, thus producing this thickening of the upper skin on the joints. Callosities of the same nature, although not so extensive, are not rare on the second finger-joints. The palm of the hand is covered with a hard, horny skin, generally beset with warts, especially at the roots of the fingers. In spite of the blackness of the skin which covers them, these characteristics are still apparent.

The fingers are united by a strong web, reminding us of the membrane found on the otter and other web-footed animals, and reaching nearly to the first finger-joint. A thick coat of hair extends to the root of the fingers, although on the backs of the fingers there are only a few isolated hairs.

The trunk of the body of a gorilla, seen from behind, somewhat resembles a trapezium in form, of which the longer of the two parallel sides extends between the shoulders, and the shorter between the two halves of the pelvis. The longitudinal sides, which are not parallel, correspond to the sides of the back. The arrangement of all the lower part of the trunk, on which the bones of the pelvis stand out prominently in an oblique direction, somewhat resembles a four-sided pyramid with its apex reversed.

The gluteal muscles are not strongly developed. The tuberosity of the ischium projects in a somewhat angular form.

While the external sexual organs of the male are so covered by the wrinkled skin of the abdomen that they are not prominent in their passive condition, those of the female are, on the contrary, very apparent; the external lips of the vagina, provided with large nymphæ, and a large clitoris, are only apparent when the sexual instinct is excited.

The thighs are covered with strong muscles, which appear to be smoothed off on the inner side, and somewhat arched on the outside. The lower part of the leg is also muscular, and its section is of a long-oval form; the region of the calf is more strongly developed than in other anthropoids. The bones of the foot are not at all prominent, and the same remark applies to those of the hand. The contour of the back of the long, broad foot is flat; the sole is convex, covered with strong muscles, and padded with layers of fat. When the animal puts the sole of the foot on the ground, its muscles go back to the region of the heel, and forward into the inner side of the foot, thus presenting the primitive formation of a heel.

The great toe, as in all apes, is detached like a thumb from the other toes, and can be used as such. The metatarsus serves as a base for its projection, in the same manner as the thumb starts from the fore part of the contour of the wrist. The great toe sometimes extends as far as the joint between the first and second phalanges of the second toe, some-

times nearly as far as the middle of the second phalanx. This characteristic varies in different individuals. At the point of union of the first metatarsal bone with the hinder extremity of the first phalanx of the great toe, there is a round projection on the inner side of the foot. The great toe is very broad at its root, then becomes smaller, and widens again into a broad final phalanx. With its strong lateral ridges of skin, which cover the sinews and cushions of fat, all this part of the foot appears to be wide and flattened off from the back to the sole.

The second, third, fourth, and fifth toes are more slender than the great toe. The second toe is in most cases rather shorter than the third. The third and fourth toes are almost of the same length, and only a little longer than the second toe.* The fifth toe is considerably shorter than the fourth. The last phalanges of the toes taper in front, and are furnished on their lower surface with long, laterally compressed pads. The section of such a phalanx is almost trapezoidal, with a long upper parallel side. The upper part of the foot, although generally flat, rises a little in the neighbourhood of the first metatarsal bone, and slopes thence to its outer edge.

The hair grows thickly on the back of the foot as far as the extremity of the metatarsal bones, more sparsely on the back of the toes. There are strongly marked oblique furrows on this part of the foot, especially on the joints, often combined with horny

* Comp. Is. Geoffr. Saint-Hilaire, table v.; also Hartmann, *Der Gorilla*, p. 14, Anm 4.

callosities, since the animal sometimes doubles up the toes and runs upon the back of them. The nails of the hands and feet are black, like the whole of their skin-covering, distinctly grooved, very much arched, and generally somewhat wider at the base than in front.

Fig. 3.—The young male gorilla, from the specimen in the Berlin Aquarium of 1876–77.

On the sole of the foot we find the region of the heel, the ball of the great toe, in this case resembling the ball of a thumb, the roots and tips of the toes, together with pads consisting of muscles, ten-

dons, and skin. The several divisions of these padded balls are separated from each other by furrows which are longitudinal, oblique, and transverse, and more or less distinct from each other. The black skin which covers the sole of the foot is thick and horny, but provided with a series of papillæ. The whole skin of an aged animal is of a deep black colour, somewhat glossy, and covered with intersecting wrinkles.

Fig. 4.—The same animal at a still earlier age.

The young male gorilla does not essentially differ from the old male in its general and external appearance. Its skull is, however, without the crest which characterizes the latter animal, and is still of a rounded form in the region of the crown and occiput. At this age the head is not so high at the back and on the top as in aged males. The orbits are less prominent, the general aspect of the face is

not so decidedly prognathous, and the bridge of the nose is shorter. The lines of the body in the young male are softer and less exaggerated, and the expression of the face is less ferocious than in an aged male. The horny callosities on the hands and feet are altogether wanting or only faintly indicated, and the hands, fingers, and toes have not arrived at the powerful development which we observe in the older animal. (Comp. Figs. 3 and 4.)

Considerable differences may be observed in the whole structure of the adult female gorilla. The animals of this sex are smaller and weaker than males of the same age. The skull of the female is smaller and more rounded than that of the male, and the great bony crests are also absent. The orbits are less prominent, and a front view of the head gives the impression of a trapezoidal form. The coronal arch rises above this trapezoid. In the male, on the contrary, the crown seems to lengthen above and behind into a pyramidal form. In the aged female the bridge of the nose is generally shorter than in the aged male, but even in this particular there is great variation in different individuals. Sometimes the bridge of the nose in a female is much depressed, and then the interval between the orbits and the end of the nose is shorter: I intentionally avoid the term *tip* of the nose, on account of the blunted form of this organ. Even when the bridge of the nose is more prominent, the interval between its end and the orbits is sometimes very short.

The aged female gorilla usually has wider cheeks,

a smaller nose, and a higher upper lip. This last peculiarity is shown in the correct and well-stuffed specimens in the museums at Paris and Lübeck. Although in the process of drying, the skin of the nose may have shrunk a little, yet there is still room for the upper lip, provided with folds which are either vertical and parallel or diverge like a fan. Owen and Mützel * have given satisfactory illustrations of these parts. In the aged female the shape of the neck is not, as in the aged male, strong and bulging, so as to resemble a cowl. Yet it is enlarged in conformity with the not inconsiderable development of the spinous processes of the cervical vertebræ, and with that of the powerful cervical muscles. Even in a young male, of the age of the specimen which was kept in the Berlin Aquarium, between July, 1876, and November, 1877, this enlargement of the neck was present in a marked degree. In still younger individuals, however, under a year old, in which the spinous processes of the vertebræ have not yet been developed, there is no such enlargement, but, on the contrary, this region of the neck takes a concave form.

In conformity with the smaller size of the body, the shoulders, arms, and thighs of the adult female are smaller than those of the full-grown male, but they are still very powerful. While giving suck, the breasts of the female are swelled in the form of a half-cone, instead of assuming the convex shape which is observed in many European women, and still more frequently in those of the negro, Indian,

* Owen, *Memoir*, etc., plate ii. ; Brehm, *Thierleben*, i. 56.

and South Sea races. The nipple is cylindrical rather than conical in shape, and covered with finely wrinkled black skin, which is sometimes hard and horny. When not giving suck, the breasts hang slackly down, like short empty pouches. The belly swells in the neighbourhood of the crest of the ilium, and increases in thickness at the groin. The external sexual organs, in the period of excitement, swell in a manner resembling the lips of a woman's pudenda.

In a young female the cranium is rounded, and the face is only slightly prominent. In aged specimens, especially in those of the male sex, there is a somewhat typical prolongation of that part of the face which lies between the eyes and the end of the nose, and this is to a slight extent apparent in the young female. Variations in form and in the extent of the prolongation are, however, apparent even at this early period. The trunk and limbs are more slenderly built than in a male of the same age.

The hairy coat of the gorilla consists of long, thick, straight or stiffly curved bristles, and also of shorter, thinner, and curled woolly hair. On the crown of the head the hair is somewhat stiff, from 12 to 20 mm. in length, and it becomes erect under the influence of anger. While the sides and forepart of the chin are only clothed with short, stiff hairs, they grow thickly on the back part of the chin, like a beard or forelock. The hairs which turn outwards from the sides of the face and on the neck are 30 or more mm. in length. On the

shoulders the hair is from 130 to 150 mm. long, hanging down on the upper arms and the back. In the middle of the upper arm the hair is from 50 to 70 mm. long, growing downwards as far as the bend of the elbow. At this point it generally begins to grow in an upward direction. On the back of the forearm it again grows downwards. In the middle of the forearm on its inner side, a parting of the hairs takes place, as one portion goes in front of the radius, while the other portion turns behind the ulna. On the back of the wrist a tuft of curved hair turns upwards; a middle tuft goes directly back; and the lower tuft, also curved, turns outwards. On the back of the hand the hairs turn towards the fingers. On the breast and belly the hairs are shorter and grow more sparsely. On the breast their direction is as a rule upwards and outwards. On the belly they converge from the ribs towards the centre and the navel. On the thighs the hairs are about 160 mm. long, and here, as on the lower part of the leg, they tend outwards, while on the back of the foot they grow towards the toes. On the back, shoulders, and on the thigh and leg, the bristles are slightly curved. This quality increases the general impression of shagginess and fleeciness which is produced by the hairy coat of these creatures. The woolly hair does not grow very thick, and is not much matted.

The colour of the hair not only differs on different parts of the body, but also in different individuals. On the crown of the head it is of a reddish brown, or rarely of a decided brown or black. The hairs in

this region are sometimes dun-coloured at the root, greyish white in the centre, and brownish red, shading into the dark brown tip. The hair on the lips is sometimes of a blackish brown, sometimes whitish, or both colours are found together. The hair growing at the sides of the face is grey below, dark brown or almost black above. On the neck and shoulders the hair is of a grey colour at the root, and gradually becomes lighter towards the tip. In the centre it is brown, shading into a lighter colour at either end, but this ringed form of colour is not universal. The tips of the hair are dark, sometimes brown or reddish. The hair on the back, on the upper arms and thighs, is whitish or light grey for half its length, with a blackish brown ring towards the tip, which is of a dark grey colour. Many of these hairs on the back have two brown rings on them. The forearms, hands, shanks, and feet are covered with hairs which are grey at the root, brownish grey, dark brown, or black at the tip. Round the posteriors there is a circle of white, grey, or brownish yellow hairs from 10 to 20 mm. in length. In both sexes variations from the colour of the coat here described are not rare. It has been already observed that the brownish red colour of the hair on the head is sometimes exchanged for another shade. In many individuals the neck, shoulders, and back are of a dark grey, brown, or even black colour. In others the forearms, hands, shanks, and feet are covered, like the rest of the body, with grey and brown hair intermingled.

The second species of anthropoid apes is the

chimpanzee. In this case also we must consider successively the aged and young male, and the aged and young female animals.

The full-grown chimpanzee is smaller than the adult gorilla. In this species also the male is larger than the female. The chimpanzee is, speaking generally, of a slighter build than the gorilla.

The head of the aged male chimpanzee fundamentally differs from that of the aged male gorilla, since the skull of the former has a depressed crown, and the transverse occipital ridge is only faintly indicated. Since the orbits are also less strongly developed than in the aged male gorilla, and the spinous processes of the cervical vertebræ do not assume the same elevated form which is characteristic of the latter species, the countenance of the chimpanzee is not of a square shape, and there is not space for the strong muscular system arching over the neck like a cowl, which is so characteristic of the gorilla. The head of the chimpanzee displays, both in aged and young specimens, the concave neck which is common among apes, that is to say, a depression between the head and the throat. In an aged male the crown of the head presents a rounded, arched contour, since, as we have already said, the prominent bony processes are wanting. Although the supraorbital arches are not so excessively prominent as in a gorilla of the same age, they are strongly developed, covered with wrinkled skin, and in this case also there is a species of eyebrow, stiff and bristly, with shorter hairs between. The large, wrinkled lids are furnished with thick eyelashes. The inner

angle of the eye somewhat resembles that of the gorilla.

A general physiognomical distinction between the gorilla and the chimpanzee consists in the fact that the bridge of the nose is shorter in the latter than in the former. In the chimpanzee this part of the organ is depressed, yet the depression is of a conical and convex form, and is covered with a network of wrinkles of varying depth. In the chimpanzee the interval between the inner angle of the eye and the upper lateral contour of the cartilaginous end of the nose is shorter than in the gorilla. There is also some difference in the form of the nose: it is on the whole flatter, the tip is less apparent, the nostrils are not so widely opened nor so thickly padded. (Fig. 3.) In the chimpanzee, as well as in the gorilla, a central and vertical furrow directly divides the triangular nostrils, and these are likewise divided from the rest of the face by the broad pear-shape furrow which surrounds them. The upper lip is generally high, sometimes as high as 30 mm.; but in some individuals it is much lower. As in the gorilla, the chin forms a triangle of equal sides, with its apex reversed.

The external ear of the chimpanzee has on the whole less resemblance to the human ear, and its contour is larger than that of the gorilla. But this organ varies so much in individuals that it is difficult to lay down any rule for its average size. It ranges from 59 to 77 mm. in length, and from 42 to 80 mm. in width. Many individuals have a distinct lobule to the ear, others not. (Fig. 5.) In this example

the helix and anti-helix are developed, in others they are wanting. The tragus and anti-tragus are more or less apparent in different individuals, as well as the other modifications of the external cartilage of the ear.

An aged male chimpanzee has broad, rather rounded shoulders, a powerful chest, long muscular

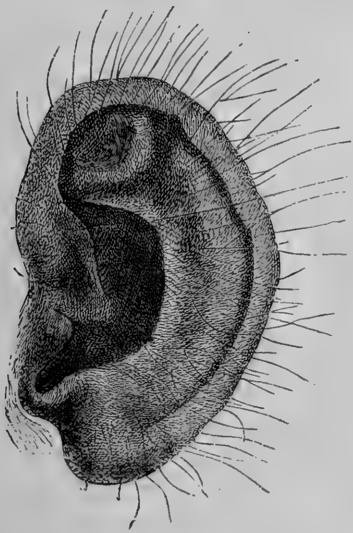

Fig. 5.—Ear of chimpanzee.

arms, reaching to the knees, and a long hand, which seems to be very slender in comparison with that of the gorilla. The thumbs vary in length, for the most part reaching as far as the metacarpal phalanges, but not in all cases. The middle finger is longer than the other three; the first and third fingers are shorter by the length of the last phalanx,

the third is a little longer than the first, and the fourth is again shorter. A web, which reaches to the middle of the first row of phalanges, stretches between the bases of the four fingers. There are horny callosities on the back of the hand of the aged male, since the chimpanzee, like the gorilla, supports himself on the backs of his closed fingers. The fingers are laterally compressed, but slightly arched on the back of the hand, and more decidedly so on the palm. A net-work of furrows covers the back of the hand, and these are more deeply impressed on its palm. The thumb is separated from the palm by a distinct furrow; and from four to six furrows of varying depth cross the centre of the palm. The finger-nails are short, wide, and arched, very convex at their free edges.

In the aged male the sides of the belly are compressed, the thighs are broad and muscular, and somewhat flattened both on the inner and outer sides. The knees are rather prominent, the shanks are somewhat laterally compressed, and the calf of the leg is very slightly developed. As in the gorilla, the long, wide feet have a thumb-like formation of the great toes, which are of considerable size. They extend, when drawing anything towards them, as far as the second phalanx of the second toe. The four other toes are more slender and only a little longer than the great toe. The heel is but slightly developed, and slopes away below. The joint between the first phalanx of the great toe and the first metatarsal bone is marked by an angular projection on the inner edge of the foot. The back of the foot

is very slightly convex. The last phalanx of the great toe is very much sloped off on its upper surface

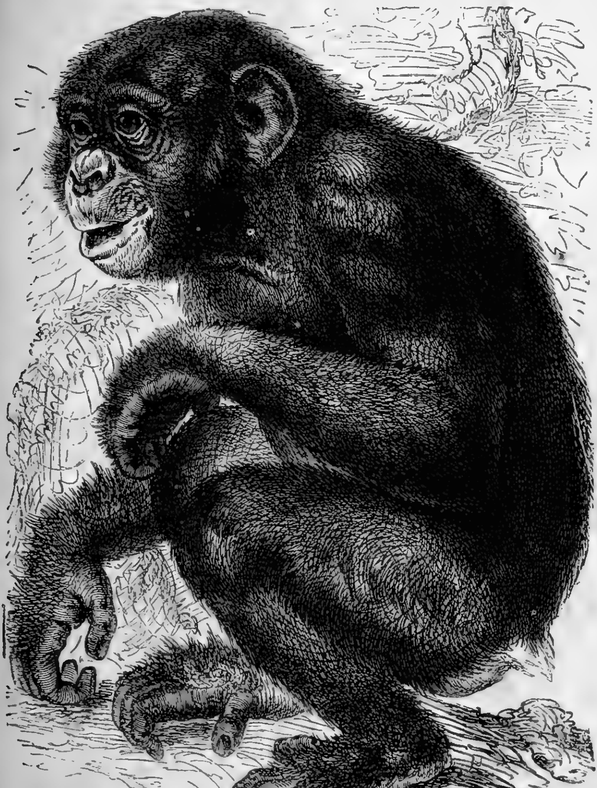

Fig. 6.—Young chimpanzee.

but this is less apparent in the other parts of this member. The last phalanges of the other laterally

compressed toes are strongly arched on the under surface. Considerable convexities may also be observed under the metacarpo-phalangeal joint of the great toe and under its last phalanx. The shape of the toe-nails resembles that of the fingers. Large callosities are not unfrequently found on the backs of the toes, since the animal sometimes supports himself on these parts. A connective web is found between all the toes except the great toe and its neighbour, but it does not extend so far as that between the roots of the fingers.

Although the young male chimpanzee is distinguished from the aged male of the same species by differences in the structure of many of its parts, yet these distinctions are not so characteristic as those between the young and aged male gorillas. The skull of the younger animal, which is altogether devoid of the prominent bony crest and ridges, is shaped almost like a truncated cone in the region of the crown; in some individuals of only a few years old, the bony development of the orbits has already begun, starting from the principal part of the frontal bone, and covered with pads of wrinkled skin. The short and depressed bridge of the nose becomes longer and higher, the cartilaginous end of the nose becomes larger, and the prognathism of the face increases with each successive stage of growth. The strength of the trunk and limbs is early developed. The sexual characteristics are gradually and plainly developed; but the male gorilla far exceeds the chimpanzee in demoniacal ferocity.

The adult female is smaller, and has a smaller head, with an oval crown to the skull. The orbits are not so strongly developed as in the aged male, the nasal parts are less prominent, and the teeth are not nearly so strong. The body of an animal of this sex is rounder in all its parts; and the belly, with its wider pelvis, is more tun-shaped than in the aged male. Neither do the limbs display the same angular formation of muscles.* The hands and feet of the female are also smaller and slenderer. In a young female the characteristics here described are presented in the mitigated form which corresponds with its youthful condition. But the female sometimes becomes a very strong and even violent creature. This was often proved in the Hamburg Zoological Garden, where a female specimen, in splendid condition, survived for several years under the faithful care of old Siegel.†

The skin of the chimpanzee is of a peculiar light, yet muddy flesh colour, which sometimes verges upon brown. Spots, varying in size and depth of colour, sometimes isolated, sometimes in groups, and of a blackish brown, sooty, or bluish black tint, are found on different parts of the body of many individuals, especially on the face, neck, breast, belly, arms and hands, thighs and shanks; more rarely on the back.

* Comp. Hartmann, *Der Gorilla*, fig. 8. This is undoubtedly one of the most successful illustrations of the chimpanzee, its habits, expression, and disposition.

† Comp. Hartmann, *Der Gorilla*, fig. 27, representing the Hamburg animal in middle age. Fig. 6 gives the wild Paulina of the German Loango expedition. The inscription, by an error of the press, states that it is a male, not a female chimpanzee.

The face, which is soon after birth of a flesh colour, merging into a yellowish brown, assumes a darker shade with the gradual development of the body. The hairy coat is sleek, or only in rare cases slightly curled, and the coarser and bristly hair is generally stiff and elastic. The parting on the forehead is often so regular that it might have been arranged by the hairdresser's art (see Fig. 6). Close behind that part of the head at which the projecting supra-orbital ridges of the gorilla generally meet, there is in the chimpanzee an altogether bald place, or only a few scattered hairs. Round the face the growth of hair streams downwards like a beard. On the neck it is from 60 to 80 or 100 mm. in length, and it falls in the same long locks over the shoulders, back, and hips. The hair on the limbs is not so long, and takes a downward direction on the upper arm, and an opposite direction on the forearm, while there is often a longitudinal parting on the centre of the inner surface of this part of the limb. On the back of the wrist the hair grows in a kind of whorl; the upper hairs turn upwards and backwards, the middle ones turn backwards, the lower ones backwards and downwards. The backs of the hands and the roots of the fingers are hairy. On the front of the thigh the hair takes a downward direction, while behind it grows backwards. On the shank it grows downwards in the region of the tibia, and turns back on the inside of the leg. The back of the foot and the roots of the toes are likewise hairy. There is a shorter growth of these scattered hairs on the face, chin, and ears. On the

supra-orbital arches there are from eight to twenty, or even more, stiff, scattered hairs, after the manner of eyebrows; and eyelashes are likewise present.

In most cases the hair of the true chimpanzee is of a black colour. Short whitish hairs may be observed on the lower part of the face and chin, as well as round the posteriors. Sometimes the colour of the hair is shot throughout with reddish or brownish black.

The orang-utan, the chief representative of the anthropoids in Asia, differs from the African forms of this group, almost at the first glance, in the height of his skull, of which the fore-part is compressed and shortened in a backward direction. In the aged male it is, however, provided with high and erect bony crests, which give a prognathous appearance to the countenance. We take an aged male as the type of our description.

The forehead is high and erect, not retreating like that of the chimpanzee; it is open, and has moderately convex frontal eminences. From the centre of the forehead a round or bluntly oval eminence sometimes projects. The supra-orbital ridges are strongly arched, yet not so prominent as that of the aged male chimpanzee, setting aside that of the gorilla. The eyes are not widely opened, nor are their lids large and furrowed, but on the lower lids there are deep wrinkles. The small bridge of the nose is generally much depressed, but sometimes assumes a slightly conical form as it issues from the central longitudinal depression of the face. The end of the nose, further removed

from the eyes than is generally the case in the chimpanzee, is not so broad as it is in the latter animal and in the gorilla. The wings of the nose are narrow and highly arched in their upper part, divided from each other by a vertical furrow, and the nostrils are small and oval, separated by a thin partition. The upper lip is high, broad, and projec-

Fig. 7.—Head and shoulders of an aged male orang-utan.

ting, and seldom much wrinkled. It is divided from the cheeks and from the upper part of the face by a deep depression; and behind the cheeks two large and long-shaped or sometimes triangular pads of fat often project forwards and downwards.

The very mobile lips are furrowed, and not remarkably thick. The chin is very retreating, but somewhat uniformly rounded in front (Fig. 7).

The small ear averages 55 mm. in length, and 12 mm. in width, and has a general resemblance in structure to the human ear (Fig. 8). On the fore-part of the short, thick neck there are irregular, and in some places very deep circular folds of skin. The throat-pouch distends part of this slack, wrinkled skin, which hangs down in front like a great empty wallet (see Figs. 7 and 9).

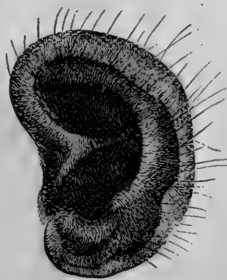

Fig. 8.—Ear of the orang-utan.

The structure of the other parts of the body lacks even to some extent the powerful and symmetrical formation which we observe in the gorilla, and indeed in the chimpanzee. The trunk, with broad yet rather angular and sloping shoulders, with flattened breast, rounded back, and still more rounded belly, is tun-shaped, and gives the impression of a want of proportion. In lean individuals the gluteal region resembles the projecting rump of a fowl, and this may also be observed in the young gorilla and chimpanzee. The long, muscular arms reach to the ankles when the animal is in an erect position, and are altogether out of proportion with the rest of the body. The powerful upper arm is shorter than the lean forearm. The hand is long and narrow. The thumb, which reaches as far as the metacarpo-phalangeal joint, has a displeasing and almost rudimentary effect. A web unites the fingers, sometimes extending along a third of the first phalanx, sometimes along half. The middle

finger is somewhat longer than the first and third

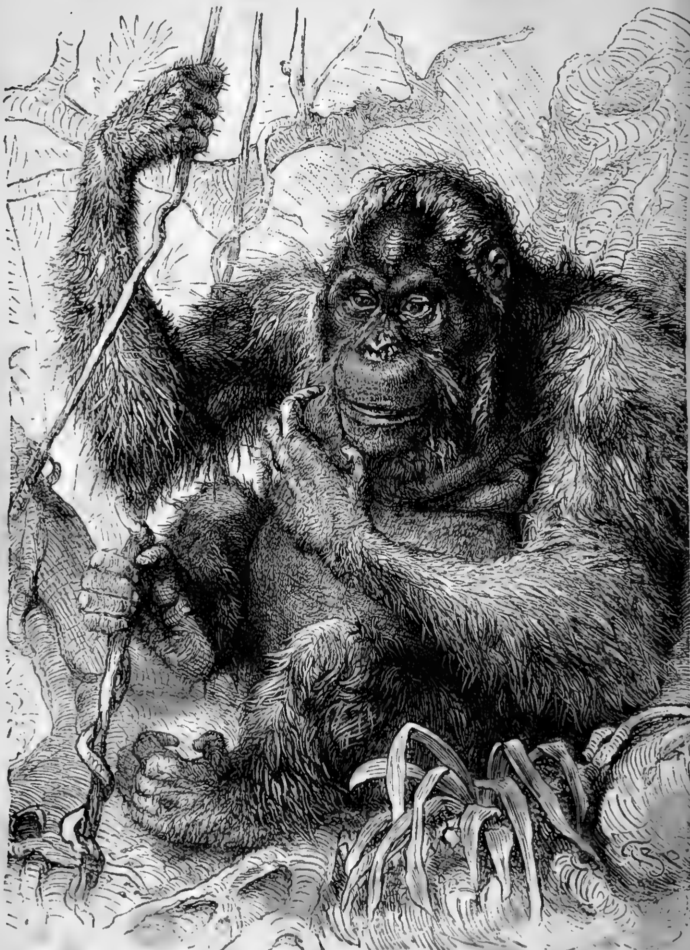

Fig. 9.—Adult male orang-utan.

fingers, and the third is next to it in length. The fourth finger is comparatively long. The palm of the hand is flat, only marked by a few deep furrows. The long, slender fingers are laterally compressed, and the nails on their tapering ends are arched.

The thighs, somewhat compressed on the inner side, are, however, very muscular, but become much smaller on their back side. The calf of the leg is less developed than in the gorilla, or even than in the chimpanzee. The feet are, like the hands, long and slender. The narrow, flat heels project very slightly behind. The great toes are short, with wide extremities, rounded above, and provided on the sole with thick, fatty skin. In old age these animals not only often lose the nails of their great toes, but sometimes even the last phalanges themselves. This is not merely a disease produced by confinement, as is the case with sea-cat monkeys, hyenas, etc., which in this condition lose portions of their tails or toes, but it also occurs among orang-utans in their wild state. The middle toe is the longest, and the fourth toe is the shortest. Layers of fat may be observed on the under side of all but the great toe, where they rarely occur. The backs of the hands and feet are covered with very ribbed and wrinkled skin, and on the hands there are callosities.

This animal, of a quieter and more phlegmatic disposition than the gorilla and chimpanzee, has a very strange appearance, with its projecting head and short neck; its face widening in the middle and tapering towards the forehead and chin; its tun-shaped trunk, long, thin extremities, and shaggy

coat. It differs widely from the chimpanzee and gorilla in these particulars. In the young male the compression of the forehead is less marked than in aged animals, and the bony crests which conduce to raise the coronal arch in its upper and hinder part are also absent. The supra-orbital arches are less strongly developed, the jaws are less prominent, and the layers of fat upon the cheeks are absent. The head is more detached from the neck, the structure of the whole body is slenderer, the expression of the countenance is milder. A small, conical nail, blunted at the end, may generally be observed on the great toe.

In the adult female, as I have pointed out elsewhere, the physical characteristics of the young male are repeated in an exaggerated form. The skull, displaying only very small bony crests, is indeed high, but more rounded than in the aged male; the face is prominent, but the head is more detached from the neck than in the latter case. On account of the greater width of the pelvis, the body is still more tun-shaped than in the aged male. When giving suck, the breasts are distended in the form of a half cone, but when this condition ceases they fall together and only present two short, wrinkled, slightly prominent folds of skin; the small, horny nipples are almost cylindrical; and the areola, of which the traces are scanty at all times, altogether disappears. The throat-pouch is less strongly developed than in the aged male, but the limbs are as fully developed. The head of the young female is still more rounded, with a more flattened though still projecting face, and the limbs are slenderer, and

thus still more out of proportion with the thick trunk than is the case with a young male.

The orang-utan's skin is of a greyish blue colour, sometimes mixed with brown, but the greyish blue shade is predominant. A yellowish or brownish grey is less common. Round the eyes, nostrils, upper lips, and chin there is often a ring of a dirty, yellowish brown colour, forming a strange contrast with the general bluish grey tone of the face. The arms, legs, hands, and feet are black or greyish black, more rarely brown or reddish brown.

The hairy coat of the orang-utan consists of long, curved, waving bristles, and some scanty downy hairs. On the back of the head, on the shoulders, back, and hips I have measured hairs from 220 to 235 mm. in length. In other individuals they were, however, much shorter—20, 40, or 60 mm. long. There is often a natural parting of the hair of the head, which falls asunder on either side. In some cases there is no parting, and the hair streams wildly down; and in others, again, it stands upright, stiffening from the sides and top of the head in a demoniacal manner (Figs. 7 and 9). A beard frequently encircles the cheeks and chin. The hair grows upwards and outwards on the neck and fore-part of the throat, on the shoulders, back, breast, belly, upper arms, and thighs, while it takes the opposite direction on the forearm. On the wrist the hair grows in the manner described in the case of the gorilla. There is only a scanty growth of hair on the breast and belly, and it is also short and weak on the face, ears, and backs of the hands and feet.

I have not observed eyebrows on the animals I have seen, but they may occur, and the eyelashes are fully developed.

The hair is of a reddish brown colour, something like burnt sienna, and the hair-tips on the back parts of the body are generally brown. In some individuals the hair is darker, of a russet or blackish brown; in others it is lighter, and in the latter case the breast and belly are of a yellowish white. The beard is sometimes dark yellow. Some individuals almost devoid of hair have been observed.

The gibbons, or long-armed apes (*Hylobates*), constitute the fourth group of anthropoids. Many kinds of this group are known, and I feel bound to describe, at any rate, a few of them, in order to be able to give an idea of their structure. With respect to these animals, I cannot only rely on the materials which are accessible to me, but must also make use of the descriptions given by others.*

The gibbons have as a rule very long arms, reaching to their ankles when they stand upright. The face is not very prognathous, the crown of the head is rounded off, and the nails are flat. There are small callosities on their posteriors, which are absent in the gorilla, the chimpanzee, and the orang-utan.

The largest species of these animals, which inhabit part of the continent and of the islands of Asia, is

* While writing these words I obtained a dried specimen, *Hylobates lenciscus* (Kuhl), injected with Wickersheiner's fluid; a large *Hylobates* of the same species, preserved in spirits of wine; another *Hylobates albimanus* (Is. Geoffr. Saint-Hilaire), preserved in the same way; and the skeletons of *Hylobates syndactylus* (F. Cuvier), and of *Hylobates agilis*.

the siamang (*Hylobates syndactylus*, F. Cuvier).* According to Diard, its arms are not quite so long as those of the wauwau (*H. agilis*, F. Cuvier). This animal's head is small, with a somewhat retreating forehead, a long, moderately arched crown to the head, and a slightly arched occiput. The base of the nose is depressed, the region of the jaws is only slightly prognathous in the aged male. According to Diard, the eyes are deeply set, the nostrils are very wide, the cheeks fall in below the zygomatic arch, the mouth opens widely, the chin is of insignificant size. It is the only one of the gibbons which possesses the throat-pouch, already described as common to the other forms of anthropoids, and in aged animals it hangs slackly down, almost bare in front. The second and third toes are connected together by a thin web, reaching to the last joint in the male, and to the penultimate joint in the female. The hairs on the forearm turn their points upward, and form a kind of whorl on the wrist. The animal is of a glossy black colour, with a thick and tolerably long coat of hair on the body and limbs. According to Bock, the face is encircled by a grey or white beard. This animal is about a metre in height, and inhabits the woods of Sumatra.

The lar (*Hylobates Lar*, Illig) is another species of gibbon. The structure of the body is much more

* A very good illustration of this animal may be seen in Ed. Poeppig's *Illustrirter Naturgeschichte des Thierreichs*, vol. i. fig. 24 (Leipzig, 1847), which is taken from some English source with which I am not acquainted. Another woodcut of this animal is in Bock's *Unter den Kannibalen auf Borneo*, p. 342: Jena, 1882.

slender than that of the animal just described; the head is round, the eyes are large, the nose projects from its depressed surroundings with only a very slight ridge, and the cartilaginous end is shaped like a triangle with unequal sides. This triangular end is divided by a longitudinal furrow, and the small nostrils converge downwards and inwards, and are divided from each other by a thin partition. The structure of the upper lip is peculiar. In the centre, just below the base of the nasal partition, it is depressed, and divided into two symmetrical lateral halves by a vertical furrow. Each of these halves forms a rounded edge, overhanging the small lower lip. Above the upper lips, between them and the zygomatic arch, which slopes away below the lower eyelids, there are the flat, depressed cheeks. The small chin presents itself below the central cleft of the upper lips and their convex rims. The face of this gibbon, of which the general appearance is very singular, is surrounded by a circle of thick hair, which resembles the circular hood of an Eskimo. This characteristic form of the head, both generally and in detail, is not confined to the lar, but applies to other species of gibbons, including the siamang (see Figs. 11 and 15). It is a feature which distinguishes the long-armed apes, almost at the first glance, from the other forms of anthropoids already described. The colour of the lar's face is reddish brown or tawny; the hair which surrounds it is of a light grey: the body is of a dark grey, with short, light grey hair on the backs of the hands and feet. The black ears are almost hairless. The lar

has up to this time seldom found a place in our zoological collections. It is found in Malacca and Siam.

The white-handed gibbon (*Hylobates albimanus*, Vigors and Horsfield) is often confounded with *H. Lar.* But *H. albimanus* has a black face, and the general colour of the skin is black, including the inside of the hands and feet. Thick white hair encircles the face, and the backs of the hands and

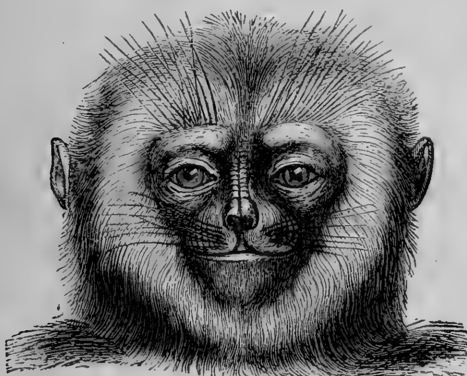

Fig. 10.—Head of the white-handed gibbon.

feet are covered with short white or light grey hairs, while the rest of the coat is quite black. The hair of the forearm grows downwards, towards the wrist. The ears of these apes are almost of the shape of an equilateral triangle. The helix of the ear runs like a flap round its free outer edge. The anti-helix passes through the centre of the slightly depressed external surface of the ear, of which the whole arrangement does not essentially differ from that of

the ear of other anthropoids. The cartilaginous substance of the organ is a good deal inflected, broad behind and in the upper part, dividing into two limbs in front and below. There are indications of the tragus and anti-tragus. The detached lobule of the ear is absent (Fig. 11). This structure of the external ear is common to other species of gibbons, although in many cases the upper part of the helix is wrinkled, and the anti-helix is sometimes more fully developed, and more like that of the human ear.

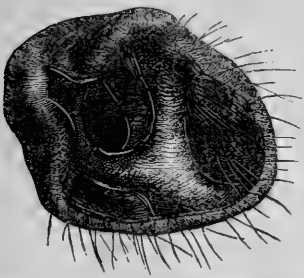

Fig. 11.—Ear of the white-handed gibbon.

The face in this species is small. The supra-orbital arches are strongly developed, and almost join in the centre. The eyes are large, dark, and have a mild and placid expression. The cheeks are prominent in the region of the zygomatic arch, and depressed below it. The bridge of the nose is imbedded between the cheeks, which, especially when seen in profile, take a slightly conical form. The nose is covered with cross-folds. Its cartilage is of the shape described in the former species, and so are the upper lip and chin (Fig. 10). Long, bristly hairs stand out on the supra-orbital arches and upper lip, and short, thin hairs cover the end of the nose. The white hairs which encircle the face grow like a beard on the chin. The whole face has a melancholy,

almost tearful expression. The neck is short, the trunk drawn out. On the long, narrow hand there is a short thumb, laterally compressed, which does not quite reach to the metacarpo-phalangeal joint. The ball of the last phalanx forms a thick, rounded pad, which is repeated in a lesser degree on the under side of the first phalanx of the thumb, and on its ball. The thumb-nail is bent back, as unlike a claw as the flattened, long, and narrow nails of the other fingers. The middle finger is only a little longer than the first, and the fourth not much shorter than the third finger (Fig. 12).

Fig. 12.—Left hand of *Hylobates albimanus.*

The foot is neatly made, short and narrow, without a projecting heel. The great toe is very long, reaching almost to the last phalanx of the second toe. The sole of the foot, and the under side of the great toe, especially its last joint, are provided with thick, rounded pads. The middle toe is not much longer than the second, the fourth is shorter again, and the fifth is only half as long as the fourth. There is only a very short web between the roots of the

fingers, but it extends much further on the toes (Fig. 13). This species of ape is found in Further India.

The wauwau (*Hylobates agilis*, F. Cuvier, Fig. 14), an ape of a rare species, may, according to Duvaucel, be recognized by his prominent supra-orbital arches, sunken eyes, a moderately flat nose, and large nostrils with lateral openings. The face of the male is hairless, and of a bluish black; that of the female is brown. The face is encircled by thick, whitish hair, through which the ears are only partly visible. There are a

Fig. 13.—Left foot of the same animal.

few black hairs on the chin. In the male the head, belly, inner surface of the arms and of the thighs are dark brown. The neck and shoulders are of a lighter shade, and the hair on the heels is dun or whitish. The backs of the hands and feet are dark brown. The sides of the posteriors and the backs of the thighs are brown, chestnut, or white. In the female the white hair which encircles the face is shorter, and verges on dun colour. The young animals are light yellow or brown. This animal inhabits the island of Sumatra.

The grey gibbon (*Hylobates leuciscus*, Kuhl) is covered with a thick, long, and woolly coat, with scattered hairs which are curly, and have two or

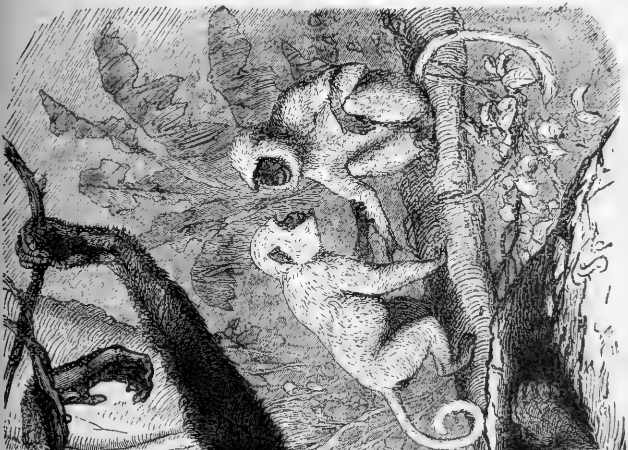

Fig. 14.—A wauwau in the left foreground (*Hylobates agilis*); in the background to the right, two slender apes (*Semnopithecus entellus*).

three rings of dark colour on a light ground. The upper part of the head is black; light, or sometimes white, hair encircles the blackish face. The general

colour is dun. The front of the throat, the breast, and belly are of a lighter shade; while the back of the neck, the shoulders, upper arms, and thighs are darker. A brown or black stripe runs down the breast and belly from the armpits. The insides of the hands and feet are black. The colour of young specimens is more uniformly grey or dun. This animal is found in Java and Sumatra.

The hulock, otherwise called yulock or yoluck (*Hylobates Hoolock*, Harlan), has, in its adult condition, a prognathous face with prominent supra-orbital arches, a long, low bridge to its nose, with high, narrow nostrils, and a very small upper lip. In aged animals there are two oblique folds over the eyes, of a light grey colour. The rest of the hairy coat, the face, hands, and feet are black, or, in the younger animals, brownish black, with grey extremities. A line of grey extends from the breast downwards over the belly. This animal inhabits the mountainous district of Assam.

The unko (*Hylobates Rafflesii*, Is. Geoff. Saint-Hilaire) is of a black colour, shading into reddish brown on the back and sides. Hair, of a grey colour in the male and white in the female, encircles the face. This ape is a native of Sumatra.

The dun-coloured gibbon (*Hylobates entelloides*, Is. Geoff. Saint-Hilaire) is so called from its coat, which is thick and woolly, and furnished with long hairs of a greyish yellow or dun colour. This coat is somewhat darker on the inner surface of the arms and on the neck, where it shades into reddish yellow. The growth of hair surrounding the face is

lighter, verging upon white. The female is generally more yellow in colour than the male, and the hair on her face is of a reddish yellow rather than white, but not without a trace of white hairs. The face and the bare places on the hands and feet are black. Between the second and third toes there is a connective web reaching as far as the first joints. This animal inhabits the Malacca peninsula. The name of the species is derived from its assumed likeness to the Indian hanuman (*Semnopithecus Entellus*, F. Cuvier), of which an illustration is given in the background to the right of Fig. 14.

The white-bearded gibbon (*Hylobates leucogenys*, Ogilby *) is remarkable for the long, erect hairs which grow on the upper and back part of the scalp, and for the long white beard on the cheeks and chin, which joins the thick growth above the eyes. The rest of the body is dark black. Its native place is doubtful.

The general colour of the tufted gibbon (*Hylobates pileatus*, J. E. Gray) is black, shading into grey on the shoulders, back, and thighs. A white ring surrounds the hands, feet, face, and scalp; and there is also a patch of white on the sexual organs, and often a patch of black on the breast. The whiskers are black. In other respects the animal varies according to its sex and age. It is found in Siam and Kambodja. †

* A specimen of *Hylobates leucogenys* (Ogilby) may be seen in the British Museum. Comp. J. E. Gray, Catalogue of monkeys, lemurs, etc.: London, 1870.

† A good woodcut of *Hylobates pileatus* (J. E. Gray) appears in Huxley's work, *Man's Place in Nature.*

The dark grey gibbon (*Hylobates funereus*, Is. Geoff. Saint-Hilaire) is of an ashen grey colour on the upper and outer side of its limbs, verging into brown; and on the under side it is dark brown. There is a narrow strip of light grey round the face, with a darker band round the back of the head. It is found in the island of Sulu.*

In addition to these species of gibbons of which we have given a brief account, there are several others—as, for example, *Hylobates concolor* (Harlan), from Borneo; *H. Muelleri* (L. Martin), from the same place; *H. choromandus* (Ogilby), from India, and many others. But since our space is limited, the description given above must suffice for a diagnosis of the species.

* A very good coloured illustration of *Hylobates funereus*, probably taken from life by Werner, may be seen in Is. Geoff. Saint-Hilaire's *Description des mammifères nouveaux, ou imparfaitement connus de la collection du Muséum d'histoire naturelle. Archives du Muséum*, v. 26.

CHAPTER III.

THE EXTERNAL AND ANATOMICAL STRUCTURE OF ANTHROPOID APES, COMPARED WITH THE HUMAN STRUCTURE.

In order to complete as far as possible the description which we propose to give of the general natural history of these remarkable animals, it is necessary to examine their anatomical structure. Yet it is not so much our aim to give a detailed and exhaustive description of their anatomy, as to glance rapidly at those peculiarities of their inner structure which catch the eye. It seems to me expedient in this case to follow the method of systematic and descriptive anatomy, and to take the several natural organs in succession. This method, which has long prevailed for studying the structure of the human body, should also be our guide in our researches in comparative anatomy. Our readers need scarcely be told that the anatomy of anthropoids is only a small branch of the comparative anatomy of vertebrate animals in general.

I begin by considering the bony structure of anthropoids, and, in particular, of the gorilla. And

it will be well to note the important differences between the structure of the skull of a young and aged male, and of a young and aged female gorilla.

The skull of the aged male animal is large and heavy. Its average weight is one and a quarter kilogrammes. The longitudinal diameter, from the

Fig. 15.– Skull of an aged male gorilla in profile.

alveolar point of the upper jaw to the occipital point, may be as much as 294 mm. The overhanging orbits are high in front, and flattened off behind, and their upper edges unite to form a ridge in the middle of the face. To these the back parts of the orbits are attached, in shape like a truncated cone, round and prominent in front, and narrowing into bony capsules in the direction of the brain-pan. They open directly in front, and the aperture is generally in the form of a regular square. The edges are seldom so blunted off as to present a figure somewhat approaching to a circle (comp.

Figs. 15, 16). The frontal bone, which in the young of both sexes is high, broad, and arched, becomes depressed in the centre in the aged male. The temporal ridges, thickened to a hem, pass over this to the coronal crest.

Fig. 16.—Front view of the skull of an aged male gorilla.

This crest is highly characteristic. It begins in the region of the frontal bone, and, rising abruptly, unites itself with the transverse occipital crest. It is of varying height,* but is rarely altogether absent in an adult male animal. On the top of this coronal

* The coronal crest has attained to a quite unusual height in the fine specimen of the skull of an aged male gorilla, No. 92, in the Natural History Museum in Paris.

crest we may see the two well-developed bony ridges which almost touch each other, and which indicate the upper limits of the temporal muscles on either side. In young animals these ridges tend downwards over the sides of the head, below the vertex of the skull. Their position and direction vary with the growth of the skull, and correspond with that of the coronal crest. The transverse occipital crest is of considerable height in the case of aged and vigorous animals, and is frequently somewhat concave in front, and convex at the back. The fore surface of this crest is formed of the two parietal bones, the hinder surface of the squamose portion of the occipital bone. The lambdoidal suture is on the top of this occipital crest, and in this case, as in that of other mammals, including man, it unites the parietal bones with those of the occiput. The point of union between the coronal and occipital crests divides the latter into two symmetrical lateral halves, curving outwards and downwards. The high, wide squamose portion of the occipital bone is somewhat flattened behind, or more rarely arched, while it is abrupt at its base and in some degree in front. Six curved lines, three on either side, opposite each other, sometimes mark the limits of the attachments of the cervical muscles on the head. The mastoid process of the temporal bone is present, but Brühl could find no trace of a styloid process on the skulls of gorillas and chimpanzees.

The squamous portion of the temporal bone is often connected with the frontal bone by the process termed Virchow's frontal process of the tem-

poral bone. The nasal bones are high, very narrow in their upper part, and widening below. When they are united in the centre of the nasal bridge, a sloping, keel-shaped projection may often be observed. The inferior turbinated bones of the nasal cavity are remarkable for their size. In the skulls of young animals the inter-maxillary bones, which are in all anthropoids early united with those of the same region, stand up high and peaked between the nasal bones and those of the upper jaw.

The crowns or prominent external surfaces of the enormous canine teeth project in the centre of the face on either side like pillars, just below the nostrils, and extend above and below the row of teeth in the two upper jaws (see Fig. 16). In this way the crowns of the canine teeth form a retreating triangular space, of which the base-line of the equilateral triangle corresponds with the row of teeth. The chin part of the lower jaw, in a front view, also takes the form of an equilateral triangle. In the latter case the base-line is covered by that section of the row of teeth containing the incisor teeth. The sides of the triangle are covered by the converging canine teeth (see again Fig. 17). The incisor teeth, enclosed between the latter, in that part of the lower jaw already described, are retreating. The rami of the lower jaw are high and very wide. The angle of the lower jaw is obtuse (Fig. 15). The front or coronoid process and the back or condyloid process of the ramus of this bone are separated from each other by a deep, hollow cleft. The condyloid process projects abruptly above, but is less marked behind.

When we consider the internal form of the skull of an aged male gorilla, the first thing that strikes us is the marked development of the frontal sinuses, and especially their width in the region of the nasal portion of the frontal bone. We next observe the wings of the sphenoid bone, and that these large concave apophyses are provided with spaces only slightly separated from each other. These sinuses are not only plainly connected with each other, but with the sphenoidal sinuses. There is a broad sinus in the malar bone, provided with vestibules, and this has a deep communication with the maxillary sinus, or antrum of Highmore, embedded in the body of the upper maxillary bone. There are, finally, sinuses at the point of junction between the coronal and occipital crests.

The maxillary region of the cranium of the young male gorilla is already somewhat prognathous, and the keel-shaped elevation of the bridge of the nose is also very apparent, but the development of these parts is not nearly so advanced as in the aged male. The whole contour of the cranium is oval, and without the high crests so characteristic of the aged male animal. It is well known that the Swedish anatomist and anthropologist Anders Retzius has classified the skulls of different races of men as long-headed (*dolichocephali*) and short-headed (*brachycephali*). In the former class, the length is considerably greater than the height; while in the latter, the difference is either slight or non-existent. The skulls of the *dolichocephali* are long and oval; those of the *brachycephali* are short, round, or square. In

addition to this division, which is of great value in the rapid and superficial, yet sound classification of racial skulls, Retzius has constituted another. He has characterized skulls of which the profile is straight, or nearly straight, as *orthognathous* (*recht-zähnige*); and those of which the maxillary region is very prominent, as *prognathous* (*schiefzähnige*). These orthognathous and prognathous skulls may be either dolichocephalic or brachycephalic.*

In applying this classification by Retzius to anthropoids, the gorillas and chimpanzees have been characterized as dolichocephalic and prognathous, the orang-utans and the gibbons as brachycephalic and prognathous. Several scientific men have sought to establish the noteworthy distinction that dolichocephalic anthropoids are found in Africa, and brachycephalic anthropoids in Asia. This distinctive characteristic is held to agree with the geographical and ethnological conditions of the continents in question.† Virchow remarks in a later work that the skull of a gorilla becomes longer with every year of life, but that this is not so much due to the cranium as such, as to its bony outworks, such as the strongly developed supra-orbital arches, the enlargement of the frontal sinuses, etc. Measurements rather tend to show that the young gorilla

* *Ethnologische Schriften, nach dem Tode des Verfassers gesammelt von dessen Sohne Professor Gustav Retzius*, p. 33: Stockholm, 1864.

† *Zur Kenntniss des Orangskopfes*, etc., p. 3. Virchow observes (*Verhandlungen der Berliner Anthropologischen Gesellschaft*, March 18, 1876): "The fact that the gibbon, as well as the orang-utan, is brachycephalous is of great geographical interest."

is brachycephalic, but that this characteristic diminishes with increasing age, at any rate, if the external excrescences are taken into account. But it is quite otherwise when the furthest point of measurement is taken from the frontal arch, not from the nasal prominence. In such a case the increase of the brachycephalic condition is established.*

In the skulls of such young males as those here mentioned, the temporal ridges, which in aged animals are in close proximity in the region of the developed bony crests, have already in some cases begun to approach each other, but they are still far apart. In young specimens we can distinguish, on each side of the parietal bones, two temporal ridges, opposite each other, and taking a nearly parallel course. The upper ridge, which loses itself on the external surface of the mastoid process, which is already developed, corresponds to the junction of the fascia of the cranial muscles (*Galea aponeurotica musculi epicranii*) with the fascia enclosing the large temporal muscles. The lower ridge, which is gradually merged in the upper edge of the zygomatic process of the temporal bone, forms the demarcation of the fleshy origin of the temporal muscle. This corresponds to the spot at which the two layers of the temporal fascia unite. In a very young male these temporal ridges can be only faintly traced; they become more strongly marked as his growth advances, and as they approximate more closely to each other on the vertex of the cranium. I have examined a

* Monthly report of the Royal Academy of Sciences, Berlin, June 7, 1880.

skull of which the sutures were still open, and could already trace the development of the coronal crest in two divisions, separated from each other by a longitudinal furrow. The upper edges of these divisions corresponded to the two temporal ridges, which were in close proximity to each other. If the animal had not died at this stage of its development, it is probable that, with advancing growth, the two divisions of the crest would have been welded into one structure. Such a condition only characterizes a transitory stage of development, repeated in each individual.

In the centre of the vertex of the cranium, where the longitudinal crest of which we have so often spoken is subsequently developed, we may often observe on the sagittal suture of the cranium of a young male a longitudinal swelling, which increases very gradually. In the region of the two upper semicircular curved lines (*lineæ semicirculares s. nuchæ supremæ*), on the squamous occipital portion, or between these and the two central cervical lines, a transverse swelling is early developed; this swelling sometimes extends to the lambdoidal suture, or, at any rate, to its neighbourhood. This bony excrescence, of which the anatomical term is *Torus occipitalis transversus*, corresponds to the first layer of the transverse occipital crest so characteristic of the old male gorilla (see Fig. 15).

In several skulls of young gorillas, in the region of the coronal suture, a small, insulated, intermediate bone may be observed (Virchow's *os epiptericum*) between the squamous portion of the temporal bone

and the greater wing of the sphenoid, with which it is sometimes completely welded. In this case there is, above the *os epipterícum*, a direct connection between the temporal and frontal bones by means of the frontal process (Virchow's *processus frontalis squamæ temporalis*), which is not rare in anthropoids.* This process often owes its origin to the *os epiptericum*, which is in its early stages attached to the temporal bone. I shall have to refer again to this frontal process.

The orbits are more rounded in young than in aged skulls; in the latter they are always angular, although the angles, especially the upper and external angles, may be more or less blunted. Virchow remarks that in the skull of a very young gorilla the height of the orbit exceeds its width, and that at that age the skull is therefore high, In the aged male gorilla the height of the orbit, according to the several measurements I have taken, varies between 39 to 52 mm., and the width between 37 to 45 mm.

The rest of the skeleton of the aged male gorilla corresponds in its powerful and massive form with the general structure of the body, which is remarkable for its height and strength (see Fig. 16). In

* Virchow, *Ueber einige Merkmale niederer Menschenrassen am Schädel*, p. 41 : Berlin, 1875. *Zeitschrift für Ethnologie*, xii. 23 : 1880. *Monatsbericht der Königlichen Akademie der Wissenschaften zu Berlin*, p. 523 : 1880. The *os epiptericum* may be observed in cranium No. 92 of the Paris collection. It is plainly seen in Fig. 4, p. 127, in *Darwinismus und Thierproduction* (Munich, 1876), in which I refer to this skull. See also Bischoff, *Schädelwerk*.

Fig. 17.—Skeleton of an aged male gorilla.*

* This illustration is from Duvernoy's *Des caractères anatomiques des grandes singes pseudo-anthropomorphes,* plate ii. It is an excellent illustration of the characteristic spinous processes of the vertebral column, and of the relative position of the limbs.

the skeleton of the trunk there are seven cervical, thirteen dorsal, and four lumbar vertebræ, thirteen ribs, and, even in aged animals, a sternum composed of several pieces of bone. The cervical vertebræ display long spinous processes, which are most strongly developed between the fourth and seventh vertebræ. The extremities of this colossal structure, combined with the elevation of the occipital region, present a convex outline when seen from behind. This structure provides the point of insertion and support for the powerful cushion of cervical muscles. The dorsal vertebræ, which increase in height, width, and depth as they stand lower on the column, taper, and are keel-shaped at their junction with the cervical vertebræ. The central parts of the widely arched ribs, which are thirteen or sometimes fourteen in number, are very thick and powerful in the aged male. Only seven pairs of ribs are attached by the costal cartilages to the sternum, and two other costal cartilages are in proximity with them. The other cartilages are only rudimentary, and the terminations in the muscular system of the belly are free. There are, indeed, variations from the type here established, and from ten to eleven ribs are sometimes attached to the sternum by thread-like strips of ligament or cartilage.

The formation of the pelvic girdle in this animal is of special interest. The chief parts of this portion of the skeleton—that is, the hip, pelvic, or innominate bones—are high, tapering in their lower part, and broad and flat above, where they terminate in the crest of the ilium, which describes a quarter

of a circle. There is, for the most part, only one small superior iliac spine, and the ischii are somewhat turned outwards, and furnished with broad, rounded tuberosities, and for the most part with only a single large sacro-sciatic notch. The horizontal rami of the pubes are narrow, while the descending rami are wide. The os sacrum is narrow, and shaped like a protracted cone, turning abruptly outwards, and resembling the basal joint of a true tail. The coccyx appears to be the rudiment of a genuine tail.

The bones of the shoulder-girdle present interesting peculiarities. The clavicles are long and slender, with a leaf-shaped, flattened end articulating with the scapula, and a thickened end articulating with the sternum. The scapula is a very large triangular bone, resembling the human scapula in its general form, and the supra- and infra-spinous fossæ are not strongly marked. The long and powerful humerus has its head inclined at an angle of sixty degrees towards the axis of the shoulder. Frequently, but not invariably, the lower, flattened extremity of the humerus is pierced on one or both sides above its rounded eminence, and this is termed by Darwin the intercondyloid foramen.

The radius has a powerful head, and a shaft considerably curved outwards while it is, on the other hand, curved backwards and inwards at the elbow. The bones of the carpus, metacarpus, and phalanges are remarkably long, broad, and deep. The development of the femur corresponds to that of the whole skeleton. Its middle piece or shaft is curved in front and flattened behind. The shaft of the tibia

is generally rounded off, but is sometimes rather laterally compressed.

The os calcis of the foot is slender, curved outwards in the centre and inwards behind the astragalus. The head, with its cuneiform extremity, is of a transverse oval shape, turned inwards. The scaphoid bone, which is generally in connection with this projection, takes the same direction towards the inner side of the foot. This peculiar contortion causes the tarsus of the gorilla to appear almost as if it had been subjected to a deviation or fracture of its longitudinal axis.

In young and adult males, as well as in young females, the structure of the bones is generally less massive than in aged males. In the female skeleton the strongly developed depressions and ridges, especially in the bones of the extremities, are absent. The head of the ulna is, for example, less deeply set in the case of a female, and its projections are smaller than in the male animal. In the female, also, the head of the radius is smaller, and the triangular shape of its shaft is less strongly marked. The pelvic bones of a female gorilla are wider, flatter, and less concave on their very projecting inner surface. They diverge more widely from each other, and this is also the case with the tuberosities of the ischium. The pubic arch is less depressed than in the male gorilla. Although the spinous processes of the vertebræ attain to some length and thickness, their development in the female is not so great as it is in the male sex.

The bony structure of the chimpanzee offers

many points of resemblance to that of the gorilla, while it differs in certain particulars from the structure of other anthropoids. And first, the size of the skeleton is smaller than that of the gorilla, which is in agreement with the smaller relative size of the body of the chimpanzee.

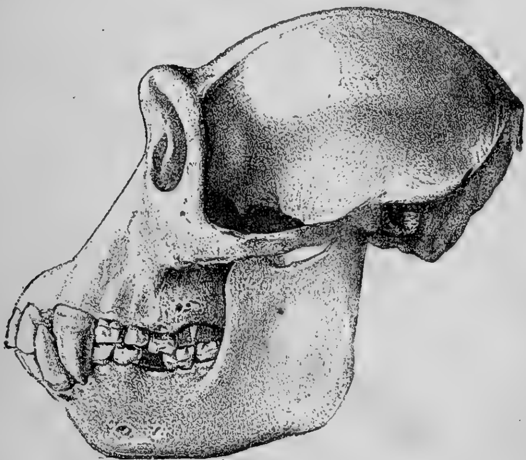

Fig. 18.—Skull of an aged male chimpanzee.

We must begin with a general view of the skull of the chimpanzee. In both sexes the frontal regions are smaller, while the coronal region is more rounded than in the gorilla. The high bony crests and prominent supra-orbital arches are wanting in the chimpanzee; the peculiar character of the bony ridges, projecting like tubes from the other parts of the skull, is less marked, and they belong more directly to the frontal region (see Fig. 18). The bony bridge of the nose is more concave in the

chimpanzee: the jaw-bones are smaller and less compressed in the centre than they are in the gorilla.

When we undertake to describe the skull of the chimpanzee in detail, it becomes necessary to consider separately the skulls of aged and young males, and of aged and young females; for in this case also the distinctions of sex and age are very evident. On the skull of an aged male chimpanzee the temporal ridges are not much developed on the coronal arch. They meet on this arch from 60 to 90 mm. behind the orbits, and form only a small coronal crest. The transverse occipital crest is somewhat developed, and at its point of union with the coronal crest the temporal ridges divide to form its upper edges. This is the case not only with the Rio Quilla skull, from which Fig. 18 is taken, but with that of the so-called troglodyte Tschégo given by Duvernoy.* In some other specimens belonging to aged male animals the presence of a coronal crest cannot, however, be detected. In these the temporal ridges are very small, and more or less distant from each other. While the transverse occipital crest maintains an almost uniform height on the gorilla skull, like a detached ridge, it is only slightly elevated behind in those chimpanzee skulls in which the crest is partially developed. In the gorilla male this ridge divides the squamous occipital portion, which is sometimes levelled, sometimes slightly convex: in the male chimpanzee this part is more decidedly arched, and

* Duvernoy, table 3, fig. B.

takes the form of a half-oval. The mastoid processes are also present in the chimpanzee. The external occipital crest and the curved lines are generally apparent. The styloid processes are more plainly traced than in the gorilla. In the latter, as well as in the chimpanzee, there is a blunt, tubular process of the temporal bone, opposite to another bony process, issuing from the occipital bone. This has been observed by Virchow, and is termed by him the carotid process (*Processus caroticus*).

The orbits of the chimpanzee are generally more rounded, with a distinctly circular rim, while the nasal bones are as long and narrow as in the gorilla. The region of the jaws is very prognathous; the external nasal openings are rounder and smaller than in the gorilla. The crowns of the canine teeth project in the same pillar-shaped form (Fig. 18). The triangular space enclosed by these and by the row of teeth in the upper jaw is often very wide and projecting, even more so than in the gorilla. But whereas in the latter the canine teeth are shaped almost like a three-sided pyramid, in the chimpanzee they are more rounded and conical. In the general structure of the teeth of both species there are certain differences of which we shall speak presently.

The brain-pan of a young male chimpanzee is still more arched than it is in aged animals. The temporal ridges are still far apart. The transverse occipital crest displays near the mastoid process well-defined wing-shaped indentations. In the skulls of very young males the transverse occipital swell-

ing of which we have spoken (*Torus occipitalis transversus*) is already developed. The orbits are distinctly detached from the skull; the bridge of the nose is depressed; the crowns of the canine teeth are, in conformity with the still slight development of the teeth themselves, less marked, and the triangular space enclosed by the teeth is less convex than in older animals.

The skull of the adult chimpanzee is, in its coronal and occipital parts, more uniformly arched, narrower, and more elongated than in aged males. The transverse occipital ridge usually develops itself in the region of the upper curved lines, or in the bony parts enclosed between these and the central lines. The nasal and upper maxillary region is depressed. That section of the upper jaw which contains the incisor and canine teeth is small. In the skulls of all chimpanzees, of whatever sex or age, the body of the lower jaw is comparatively small, with two low but wide rami, of which the coronoid and condyloid processes are divided from each other by a comparatively wide cleft. The rami of the chimpanzee's lower jaw are still more abruptly retreating than is usually the case in the gorilla.

The skull of a very young female gorilla is shaped almost like a half-sphere. The orbits are scarcely detached from the forehead; the want of elevation of the orbital arch, and the slighter prognathism of the jaw, is marked by the deep depression between it and the nose and forehead (Fig. 20).

The cancellous texture of the bones of the chim-

panzee's skull admits of a whole system of cavities communicating with each other, which are of the nature of the so-called sinuses present in the frontal, sphenoid, ethmoid, and maxillary bones of the human skull. In the chimpanzee, however, the sinuses are more extensive than in man, or even than in the gorilla. The large cavities of the forehead communicate with those of the nose and jaws. The sphenoidal sinuses and ethmoidal cells are large and deep. The greater wings of the sphenoid bone and its pterygoid processes are provided with considerable cavities. The mastoid cells of the temporal bones are in connection with the cells of the greater wings and pterygoid processes of the sphenoid bone, and also extend through the squamous portions and zygomatic processes of the temporal bones, losing themselves in their upper part in the smaller cells of cancellous bone which are found between the outer and inner walls of the skull. These are of more uniform shape and size.

Fig. 20.—Skull of a very young female chimpanzee.

The skeleton of the chimpanzee, in accordance with the smaller size of the species, is relatively of a slenderer build than that of the gorilla. The spinous processes of the seven cervical vertebræ are more slightly developed, and have undivided extremities. The transverse processes of the fifth and sixth cervical vertebræ are almost of the same shape as cervical ribs. There are thirteen dorsal vertebræ, somewhat laterally compressed:

Fig. 20.—Skeleton of the forearm and hand of the Central African bam-chimpanzee. *a*, Ulna. *b*, Radius. *c*, Scaphoid bone. *d*, Semi-lunar bone. *e*, Cuneiform bone. *f*, Pisiform bone. *g*, Trapezium. *h*, Os magnum. *j*, Trapezoid. *k*, Unciform bone. *l*, Phalanges of thumb. *m*, Metacarpal bones. *n*, Phalanges.

this compression is greater than in man and in the gorilla. The four lumbar vertebræ of the chimpanzee are furnished with long, thin, rib-like transverse processes. The so-called mammillary processes of the final vertebra are strongly developed in the male. The intervertebral foramina are small, as they are also in the gorilla and orang-utan. The thirteen ribs of the chimpanzee remind us of the human structure. The collar-bone is slightly curved, as in the gorilla. There is a marked difference between the sexes in the structure of the scapula which is broad and three-sided in the male, small and leaf-shaped in the female.

The humeri have slender shafts, with well-developed condyles and ridges. The bones of the forearm are much curved, so that the interval between them is, as in the gorilla, somewhat wide. From the wrist to the final phalanges the hand is more slender than in the gorilla.

The pelvis in this species of ape has high, narrow ilia, spreading in their upper parts, and pro-

jecting forwards, so as to form the cavity of the abdomen, and, especially in the male sex, the anterior spines of the ilium are more strongly developed than in the gorilla and orang-utan. The ischiatic tuberosities are of a spreading form, and diverge considerably from each other. The pubic arch is deeply hollowed, but the point of juncture is elevated. As in the gorilla, the os sacrum resembles the basis of a tail, but it is less developed and less conical in form.

In the chimpanzee, as well as in other anthropoids, the coccyx gives altogether the impression of a laterally compressed and rudimentary tail. This is especially the case in young animals, in which the coccyx always appears to be very narrow and prolonged. In older animals this part gradually widens, yet without losing its resemblance to a rudimentary tail.

The head of the femur resembles a section of a sphere, of which the upper part is sometimes wanting. Its shaft, which is curved in front, is much slenderer in the female than the male. The patella is oval. In the tibia the narrow shaft is laterally compressed, and bent inwards. The bones on the inner side of the foot take a backward direction, while those on the outer side, attached to the fibula, turn outwards.

In the ankle-joint the head of the astragalus is much arched, and turned inwards. The scaphoid bone is thick and deeply hollowed. The metatarsal bones and phalanges have a considerable upward convexity (Fig. 21).

The skeleton of the orang has also its special characteristics. We have already remarked, in describing the external form of the heads of these animals, that the skull is high and projecting, and retreating in its hinder part. In the old male orang this part of the bony structure is of smaller size than in the old male gorilla. The arch of the cranium is shorter and rounder than in that animal and in the chimpanzee. The central longitudinal crest of the vertex is present, but in accordance with the more spherical shape of the coronal part of the cranium, this crest is more arched above than in the gorilla, in which it slopes gently upward to the transverse occipital crest, which rises high and peaked from the back of the head. This latter crest is indeed developed in the orang, but it is not so high, and is more retreating. In consequence of this formation, the upper posterior part of the gorilla-skull appears in profile to be much more abrupt and peaked than that of the orang. In the latter, also, the orbital arches are not so high and abrupt, and not so much detached from the rest of the skull. In the orang the squamous occipital portion declines abruptly in front and below, yet it is generally more arched than in the gorilla.

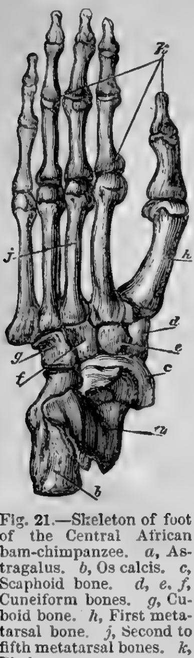

Fig. 21.—Skeleton of foot of the Central African bam-chimpanzee. *a*, Astragalus. *b*, Os calcis. *c*, Scaphoid bone. *d*, *e*, *f*, Cuneiform bones. *g*, Cuboid bone. *h*, First metatarsal bone. *j*, Second to fifth metatarsal bones. *k*, Phalanges.

The orbits of the orang, which are sometimes rounded, sometimes more square, are divided from each other by a narrow partition. The space between them and the anterior nares is not so great as in the gorilla. While in the last-named animal the space between the root of the nose and the teeth of the upper jaw-bone is convex, in the

Fig. 22.—Skull of middle-aged female orang.

chimpanzee it is generally vertical, and in the orang it is depressed (Fig. 22). The maxillary parts, furnished with strong canine teeth, are very prognathous, yet hardly to the same extent as in the chimpanzee. The body of the lower jaw is high, and its rami are high and wide. The bony crests of which we have spoken are absent in the female.

The coronal part and the squamous occipital parts are arched; the upper jaw is smaller, and the lower jaw is also less massive, than in the male animal. In very young animals the predominance of the strongly arched cranium over the countenance is apparent, and the increase of size in the latter occurs gradually (Fig. 23).

The anterior nares are narrow at the top, and wide at their base. They are more decidedly pear-shaped (*Apertura pyriformis*) than those of the gorilla and chimpanzee. In the latter animals these apertures are generally wider and more uniformly rounded. Bischoff justly observes that the bony part below the orbits, which in the gorilla is wide above, tapering away in the lower part of the face, is narrower and more vertical in the orang. The nasal bones of the orang are high and of moderate width. Brühl mentions the styloid process of the orang's skull, which is, however, somewhat abortive when we compare it with that of the human skull. It has its origin in a tolerably deep groove. On the other hand, Brühl, as we have already observed, can find no trace of the styloid process in the skulls of the gorilla and the chimpanzee! *

There are many large-celled bony cavities in the orang's skull. These may be observed in the greater wings and pterygoid processes of the sphenoid bone, in the mastoid and squamous parts of the temporal bones, in the lachrymal bones, in the body, and in the condyles of the occipital bone, and in the zygomatic arch. The larger fore-cells on the squamous

* Bruhl, *Zur Kenntniss des Orangkopfes*, pp. 2, 3.

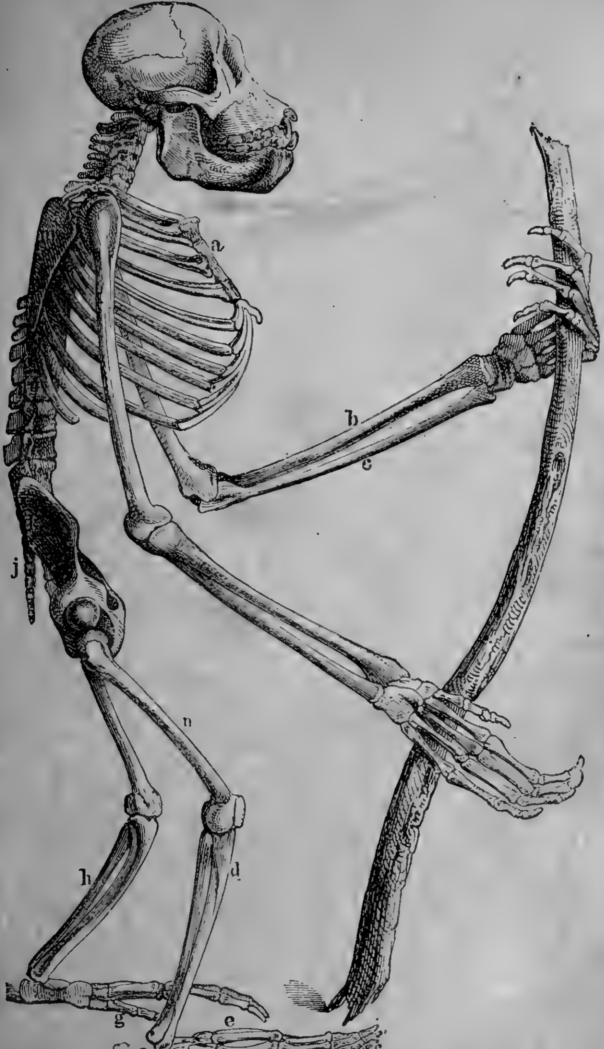

Fig. 23.—Skeleton of young orang-utan. *a*, Sternum. *b*, Radius. *c*, Ulna. *d*, Tibia. *e*, Metacarpus. *f*, Phalanges. *g*, Great toe. *h*, Fibula. *j*, Hip-bones. *k*, Coccyx. *l*, Vertebral column. *m*, Scapula. *n*. Femur.

part of the temporal bones are connected by a wide aperture with the sinuses of the greater wings and pterygoid processes of the sphenoid bone. A sinus which may be observed on the greater wing generally communicates by a large round hole with the temporal cells. There is generally, but not always, a communication between the sinuses of the greater wing and pterygoid process and the nasal cavity. These cavities sometimes communicate with each other through a wide aperture at the base of the nose. The squamous part of the temporal bones has a cellular sinus, which communicates with the cells of the mastoid process, in its lower part with the tympanum, and in its fore-part with the ossicles of the lower wall of the tympanum. The maxillary sinuses are in connection with the cells of the lachrymal bone. There is nothing in the orang's skull corresponding to the Vidian canal of the sphenoid bone, but it may be traced in the gorilla and the chimpanzee.

The vertebral column of the orang has not the same colossal spinous processes which distinguish that of the gorilla. It differs also in many other, though less striking, particulars both from the gorilla and the chimpanzee. In the orang there are generally twelve dorsal vertebræ, tapering in their lower parts; while their long, thick, transverse processes, which are full of knots, take an upward direction. The upper articular processes of the four lumbar vertebræ present short and rather insignificant mammillary processes. The sternum of the young orang is generally formed of one large

upper bone, with six smaller bones below. In older animals the body of the sternum appears to consist of a tier of three bones connected together. The ribs resemble those of the human skeleton, the lavicle is long and straight, and the scapula also resembles that of a man in form. The flat pelvic bones of the orang also turn outwards; the ischiatic bones are short, with spatula-shaped tuberosities; the pubic arch is high, and the obturator foramen is narrow and oval. The sacrum and coccyx do not resemble a rudimentary tail so much as in the case of the anthropoids we have already described. We are reminded of the human structure in the humerus, of which the shaft is much curved behind, and on its outer side. The ulna is very slender, and provided with a protracted, jagged styloid process. The neck of the radius is tapering, while its shaft is arched like that of the ulna, and the anterior border and oblique line are sharp. The wrist, metacarpus, and fingers are long and narrow.

The femur of the orang is remarkable for its large head, shaped like a section of a sphere, and its slender shaft. The latter is less bent than in the gorilla. The patella, which, in my opinion, should be classed among the so-called sesamoid bones, is in this case of an irregular form. The shank and foot-bones are remarkably slender. The scaphoid is tapering; the head of the astragalus does not turn inward so much as in the gorilla. The hinder surfaces of the metatarsal bones and of the phalanges turn decidedly outwards.

We have now to consider the bony structure of

gibbons, in which there are many specific variations which our space will not allow us to consider in detail, but a slight sketch of their organic system must be given. The brain-pan of this animal's skull is of an oval shape, without the crests so characteristic of other anthropoids, and even in the aged males of this species their development is so slight as to be scarcely perceptible. The occipital bone of male animals is, indeed, generally rounded, and the whole occipital portion is somewhat compressed in a downward direction, while the coronal region is at the same time flattened. The cranium gradually widens behind, so that, when seen from above, its form is somewhat pear-shaped. In aged males the orbits project from the low, retreating frontal bone, and are surrounded by a bony, circular rim.

The face is not very prognathous, and the short wide nasal-bones form a wide, depressed partition between the orbits. The edges of the jaw-bones describe a parabolic curve and are considerably elongated. The palate is consequently long and narrow. The rami of the lower jaw are wide and low, and their coronoid processes are only slightly developed. In aged males the teeth, and especially the canine teeth, are long and projecting; yet, comparatively speaking, they never attain to the great development of those of other anthropoids.

The number of vertebræ seems to be subject to considerable variation even in the same species, and various estimates are given by different naturalists. Müller, for example, has said that in several

species (*Hylobates syndactylus*, *H. leuciscus*, *H. variagatus*, and *H. concolor*) there are thirteen dorsal, five lumbar, six sacral, and four coccygeal vertebræ. Cuvier counted in the siamang, thirteen dorsal, five lumbar, four sacral, and three coccygeal vertebræ. In *Hylobates agilis* I counted thirteen dorsal, six lumbar, five sacral, and four coccygeal vertebræ. *Hylobates syndactylus* has long coccygeal bones, and an elongated os sacrum, which gives the impression of serving for the application of a short tail, or, indeed, of being in itself a rudimentary tail. In other respects the cervical, dorsal, and lumbar vertebræ differ little in structure from those of man.

The ribs on the sternum, which widens abruptly outwards, are strongly arched. The lowest of these project, owing to the width of the shaft. In the sternum there is a want of proportion between the smallness of its body and the size and width of its extremity. The ensiform appendix of this bone is long and wide, and spatula-shaped at its lower extremity. In the shoulder-girdle the clavicles are very slender, and much arched. The scapulæ, on the other hand, are high and narrow, spatula-shaped, and provided with a steeply projecting acromion process, a strongly developed coracoid process, and deep glenoid cavities. The upper limbs are, in conformity with the general structure of these apes, very slender; the shafts of the bones of the upper and forearm are elongated, with small extremities. The condyles are small, especially those of the elbow. The bones of the wrist, the metacarpus, and the fingers are also long and slender.

In the pelvis we note that the ilia are narrow below, and expand in the form of a spatula above, and that their position is almost vertical. Their inner surfaces are only slightly concave, and are directed somewhat forwards. The ischiatic bones are low, with wide, flattened, rugged tuberosities, and rounded *foramina obturatoria.* The ischiatic rami project forwards in an almost horizontal direction. There are large prominences on the pubic arch of the siamang.

The leg-bones are much shorter than those of the arm. The heads of the femurs stand out plainly from their short necks and large trochanters, as segments of perfect spheres. In this case, as in that of other anthropoids, the third trochanter (*trochanteres tertii*), often so apparent in the human femur, is barely indicated. The shank-bones are arched. The tibia is often laterally compressed, so that its transverse section forms a scalene triangle. The malleoli are compressed from before backwards. The elongated heel-bones appear to be laterally compressed. The canal between the astragalus and the os calcis (*Sinus tarsi*) is very wide. The metatarsal bones and phalanges have large bases, long slender shafts, and heads projecting on the under side. Even the final phalanges are long and slender.

We shall now find it profitable to compare the external characters of anthropoids with those of man. We are sometimes disposed to see the true likenesses of anthropoid apes in dark-skinned, naked savages. These savages are often insufficiently fed,

the skin is wrinkled, the face, even at an early age, is deeply furrowed, and their general appearance is neglected. The dark silhouette of such people

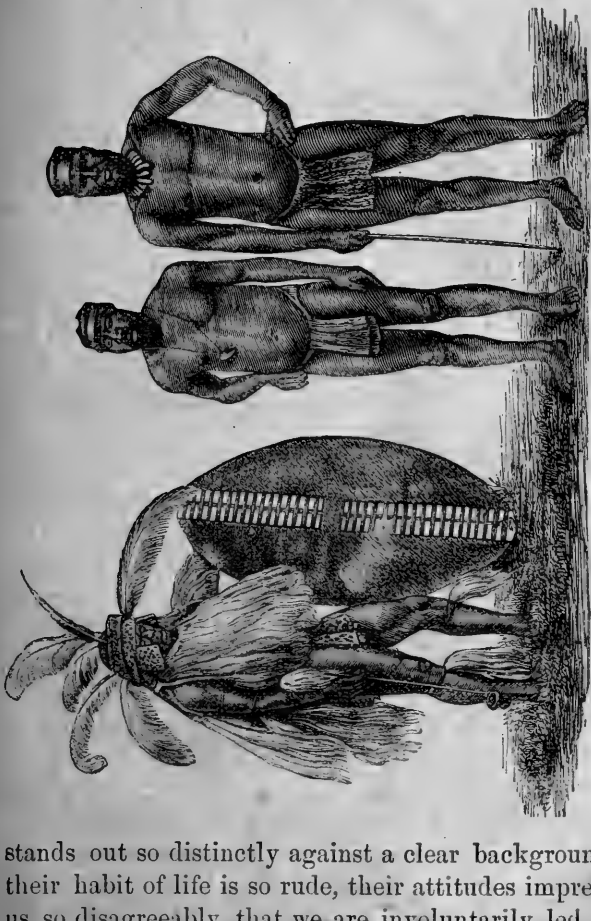

Fig. 24.—The Zulu king, Ketchwayo, in fighting array, with two of his men.

stands out so distinctly against a clear background, their habit of life is so rude, their attitudes impress us so disagreeably, that we are involuntarily led to

makesuch a comparison. This tendency unfortunately gives a wide field for exaggeration among dilettanti naturalists, and such as are zealous to establish a preconceived theory. A conscientious inquirer must, however, be cautious, and avoid too great generalization in such comparisons. For instance, much has been said of the pithecoid structure of all African negroes, yet this only applies to some peculiarly hideous races, in a state of physical degradation. There are many negro tribes in different parts of Africa which are remarkable for their well-formed bodies, and for a not ignoble bearing. The warlike demeanour of the natives of Ashanti, Dahomey, and Ibos is well known. Although the Hausanese are flat-nosed and thick-lipped, yet when armed and dressed in uniform, as we see in the photographs of Captain Glover's force, their military bearing is very apparent. The tribes of Schilluk, Nuehr, Bari, Niam-Niam, and A-Bantu present examples of distinguished warriors, however rude and savage. Dabulamanzi, commander of the Zulus at the butcheries of Isandlhwana and Ulundi, and his chiefs, give me, in a photograph in my possession, the impression of gallant warriors, however uncivilized. In all these cases it is difficult to establish the resemblance to anthropoid apes (see also Fig. 24).

The Papuans, especially on the Australian continent, are generally classed with the African negroes in such comparisons. We admit that a horde of Australian blacks, degraded by hunger and fatigue, emaciated and dirty, may, as they roam through the shadeless woods, the steppes and thick scrub of their native country, present a strange and brute-like ap-

pearance. And if the foreign intruder takes a coarse pleasure in giving drink to these savages, their immodest gestures may afford a revolting impression of their bestial nature. Yet the habits even of these dark-skinned savages are altogether different under more favourable conditions. Although of small stature, they are not badly proportioned, and their manners and bearing are capable of improvement, so that they can act as native police, messengers, etc. This was the case also with the natives of Queensland, Australia, whom I saw in the Zoological Gardens, Berlin, throwing the boomerang. Even in these tamed savages, however, we must note the projecting orbits, the deep depression between the forehead and nose, and the flatness of the latter organ. There are aged, wrinkled bushmen, negroes, Papuans, Malays, Japanese, and Mongols of inland Asia whose countenances are altogether pithecoid. And such a cast of face may even be found in Europe.

Some years ago, Mr. Bond, a land-surveyor in British India, asserted that he had found the missing link between man and apes in the mountainous district of the Western Ghauts. And indeed, the race he describes seems to have a strong resemblance to apes. "The forehead is low and retreating. The lower part of the face projects like the muzzle of an ape; the legs are short and bent outwards. The trunk and arms are comparatively long. The hands and fingers are contracted so that the latter cannot be freely extended; a thick skin covers the hollow of the hand and the

fingers, especially their tips; the nails are small and imperfect; the feet are broad, and covered both on their backs and soles with a thick skin. This tribe seems to worship nature. They have no fixed dwellings; they live chiefly on roots and honey, and exchange the latter, together with wax and other productions of their forests, for tobacco, clothes, and rice." *

Nothing more, so far as I am aware, has been published concerning this race. The description given above leaves much to be desired. The assertion respecting the contracted fingers is obscure, and such a condition is directly opposed to any resemblance with the flexible hand of apes.

Let us turn from a tribe of which the existence is still dubious, to consider the portraits we subjoin

Fig. 25.
Aidanill, hairless Australian.

Fig. 26.
The same in profile.

of a man and woman, aborigines of Queensland, in a district watered by the Ballone. These are Aidanill, the brother, and Dewan, the sister,

* "The Missing Link," *Engineering and Mining Journal*, xx. 3: New York.

members of a hairless family. The indefatigable Miklucho-Maclay went to Gulnarber, 140 miles from Tulba, in order to examine them, and took the photographs from which our illustrations are taken.*

A likeness to the chimpanzee, when deprived of its hair, may be traced in the keel or roof-shaped form of the skull; in the prominence of the supra-orbital arches; in the deep depression between the forehead and nose, of which only the centre of the bridge has a slight vertical elevation; in the broad, flattened nostrils, bounded by deep furrows; in the wide, fleshy mouth, and the large, laterally projecting ears. Gratiolet and Alix give such a head in their treatise on *Troglodytes Aubryi* (Figs. 25, 26, 27). When we add to this the dark brown skin, the deeply furrowed countenance, and the dark brown eyes, as they are described by Miklucho-Maclay, the external resemblance between many of the Australian aborigines and apes becomes more marked.

Projecting ears are common among men of different races, and I have observed them in Europeans who are otherwise well formed. Even in this latter case the effect is ape-like. Much has been said of the resemblance which may often be observed between the human ear and that of apes. It is admitted that hardly any part of the organism varies so much in its characteristics as the external ear. This is the case with anthropoids, and almost more frequently with men. Individuals of all nations

* *Report of Anthropological Society*, Berlin, April 16, 1881.

are found with defective development of this or that characteristic helix, angle tragus, notch concha, and fossa, with lobules imperfectly formed or altogether absent. I have frequently observed such misshapen ears, which vary from the perfect type, and bear a certain resemblance to the ear of apes, among the hard-featured peasantry of Germany, Switzerland, France, Italy, and Poland, who cannot be said to count beauty as part of their inheritance. In Africa I found this defective formation more common among the Maltese, Greeks, and Turks who were living in the country, than among the fellaheen, Berbers, and negroes. The latter have been unjustly charged with the possession of "hideous ape-like ears," whereas, among the African races, these organs are, in the majority of cases, of a pleasing form. With respect to the Australian blacks, and to the Malay, Mongolian, and Indian races, I cannot rely on my personal observation. According to my very limited experience, there is much individual variation among these races, and ears of the hideous, ape-like formation might be sought for with success. The specific resemblance to apes can, indeed, only be ascertained by one who is accurately acquainted with the organism of these animals. These and similar ideas are often expressed

Fig. 27.—Dewan, Aidanill's sister.

by the unlearned, who do not really understand the characteristics in question.

Darwin speaks of the anthropoid form of the ear in the chimpanzee and orang.* "The ears of the chimpanzee and orang are curiously like those of man, and I am assured by the keepers in the Zoological Gardens that these animals never move or erect them, so that they are in an equally rudimentary condition, as far as that function is concerned, as man. Why these animals, as well as the progenitors of man, should have lost the power of erecting their ears, we cannot say. It may be, though I am not quite satisfied with this view, that owing to their arboreal habits and great strength they were but little exposed to danger, and so during a lengthened period moved their ears but little, and thus gradually lost the power of moving them. This would be a parallel case with that of those large and heavy birds, which from inhabiting oceanic islands have not been exposed to the attacks of beasts of prey, and have consequently lost the power of using their wings for flight.

"The celebrated sculptor, Mr. Woolner, informs me of one little peculiarity in the external ear which he has often observed both in men and women, and of which he perceived the full signification. His attention was first called to the subject whilst at work on his figure of Puck, to which he had given pointed ears. He was thus led to examine the ears of various monkeys, and subsequently more carefully those of man. The peculiarity consists in a

* Darwin's *Descent of Man*, p. 21.

little blunt point, projecting from the inwardly folded margin, or helix. These points not only project inwards, but often a little outwards, so that they are visible when the head is viewed from directly in front or behind. They are variable in size and somewhat in position, standing either a little higher or lower; and they sometimes occur on one ear and not on the other. Now the meaning of these projections is not, I think, doubtful; but it may be thought that they offer too trifling a character to be worth notice. This thought, however, is as false as it is natural. Every character, however slight, must be the result of some definite cause; and if it occurs in many individuals deserves consideration. The helix obviously consists of the extreme margin of the ear folded inwards; and this folding appears to be in some manner connected with the whole external ear being permanently pressed backwards. In many monkeys, which do not stand high in the order, as baboons and some species of macacus, the upper portion of the ear is slightly pointed, and the margin is not at all folded inwards; but if the margin were to be thus folded, a slight point would necessarily project inwards and probably a little outwards. This could actually be observed in a specimen of the *Ateles beelzebuth* in the Zoological Gardens; and we may safely conclude that it is a similar structure—a vestige of formerly pointed ears—which occasionally reappears in man."

I subjoin an illustration of the human ear, in which the pointed tip mentioned by Darwin may be

easily discovered. This point may also be perceived in the ears of anthropoids, and especially in those of the orang-utan. Meyer has attempted to show that this Darwinian pointed tip is only due to the abortive development of part of the helix, and in this case we should not regard the occurrence as an ape-like pointing of the helix, but rather as its partial interruption owing to the pathological condition of that organ.* In a later edition of his work, Darwin admits, in reply to Meyer, that this explanation may apply to many cases in which there are several very small points, or when the whole of the helix is sinuate. In one case, photographed by Darwin, the prominence was so large that, if we were to assume with Meyer that the ear would have been normal if the cartilage had been uniformly developed along the whole extent of the helix, the latter must have occupied a third part of the ear. Two cases were mentioned to Darwin in which the upper edge of the ear had no inner fold, and was so pointed that it was very like that of an ordinary mammal. The ear of the fœtus of an orang given in Darwin's illustration appears to be pointed, although in the adult animal that organ is very like the human ear. The Darwinian tip may also be seen in the fœtus of an orang described and illustrated by Salvatore

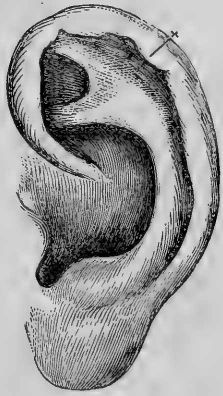

Fig. 28.—Human ear.

* Virchow's *Archiv. für Pathologische Anatomie*, liii. 485: 1871.

Trinchese in the *Annali del Museo civico di Storia Naturale di Genova* (1870). The tip of the helix is pointed in very young individuals of the gibbon species, especially in *Hylobates Lar*. Among the lower apes the pointed ear is very common (see Fig. 29).

Fig. 29.—Magot (*Innuus ecaudatus*).

The eyelids of anthropoids greatly resemble those of man in their structure. In adult gorillas and chimpanzees there is always a semilunar fold (*plica semilunaris*) corresponding to the *membrana nictitans*, or third eyelid of birds. In man there exists, instead of this, only a rudimentary apparatus, the *caruncula lachrymalis*. In some individuals it attains to a considerable size, as I have observed in the fellaheen, Berbers, Shillook, and other tribes. On the other hand, the conversion of the caruncula into a true, although only rudimentary, *plica semilunaris* has not been observed by me in the human eye. Miklucho-Maclay describes the caruncula in Melanesians (the Papuans of New Guinea), in the Orang-Sakay (of the Malay peninsula), and in the Mikronesians (of the island of Japan and of the Palau archipelago), as two or three times as wide as that of the average European.*

* *Report of Anthropological Society*, Berlin, March 9, 1878.

The eye of the young male gorilla which was kept alive in the Berlin Aquarium from 1876–77 was carefully examined by me in June, 1877. I found that the sclerotic membrane of the eyeball was whitish, surrounded by a dark brown ring. A second darker ring, sharply defined, surrounded the cornea. The iris was of a yellowish brown. The sclerotic membrane, however, gradually deepens in colour so as to give the effect of a uniform dark brown. The iris retains a light brown colour for a longer period, but it darkens with age. In an aged animal there is no brightness in the eye, except from reflected light. In the chimpanzee the iris is light brown, verging on yellow; and this is also the case in the orang.

The expressionless, indifferent look of anthropoids has often been observed, and undoubtedly chimpanzees and orangs generally gaze placidly before them. I have, however, observed an animated expression in the eyes of the former species, and W. L. Martin has also observed a flash and brightening of their eyes. I shall never forget the expression of malicious anger in the eyes of the female animal Mafuca, at Dresden, as soon as she was teased. The expression of the eyes of the gorilla in the Berlin Aquarium also changed frequently, especially when he was about to perform some mischievous trick, or when he was provoked to anger. The expression of this animal was very human, but necessarily it could only recall the darkly coloured eyes of negroes and other black races. In 1876 there were two very young orangs in the Berlin Aquarium, one hairy and the other hairless. These animals clung together in

a close embrace. If they were separated, their eyes became bright and restless, and they again sought to embrace each other while uttering plaintive cries. On tickling one of the animals under the chin, it made a most absurd grimace, and its eyes brightened, as Martin has observed in similar cases. The eyes of the gibbons which I have observed had a thoroughly mild and placid expression, rarely animated by any fire.

The instance we have mentioned of hairless Australians is the more remarkable since these aborigines are for the most part distinguished for their luxuriant growth of hair. The Australian blacks and the Ainos of Yedo are, as a rule, perhaps the most hairy races in the world. It is known, however, that in all countries and climates exceptional cases are found of individuals whose bodies are wholly or partially covered with hair, and these conditions sometimes affect whole families. Interesting historical and morphological researches respecting these hairy men have recently been made by von Siebold, Ecker, Virchow, Bartels, and Ornstein. In many of these cases we are presented with decidedly brute-like phenomena. The Mexican woman Julia Pastrana displays the strongest resemblance to apes. Other hairy men remind us at the first glance of some of the canine species. In all races the women are less hairy than the men. Darwin states that in the females of some species of apes the under side of the body is less hairy than in the males, and this is also the case with anthropoids, especially with the chimpanzee.

The beard is, as we know, common to man and apes. Among apes it is more strongly developed in the male than in the female, and this is also the case in the human species. Darwin points out that the growth of the beard both of men and apes occurs at the period of their sexual maturity, and also that there is a remarkable parallel between men and apes in its colour. For when the human beard varies in colour from the hair of the head, which is frequently the case, it is, without exception, of a lighter, and generally of a reddish hue. Darwin observed this in England, and Hooker found no exception to the rule in Russia. J. Scott carefully observed the numerous races which are to be found in Calcutta, as in other parts of India, namely, the two Sikh races, the Bhoteas, Hindus, Burmese, and Chinese. Although most of these races have very little hair on the face, Scott found that in all cases without exception, in which there was any difference in colour between the hair of the head and the beard, the latter was of a lighter shade. In apes the colour of the beard often differs widely from that of the hair of the head, and in such cases it is always of a lighter shade, often white, sometimes yellow or reddish.

"It is well known," says Darwin, "that the hair on our arms tends to converge from above and below to a point at the elbow. This curious arrangement, so unlike that in most of the lower mammals, is common to the gorilla, chimpanzee, orang, some species of Hylobates, and even to some few American monkeys. But in *Hylobates agilis* the hair on the

forearm is directed downwards or towards the wrist in the ordinary manner; and in *Hylobates lar* it is nearly erect, with only a very slight forward inclination; so that in this latter species it is in a tran-

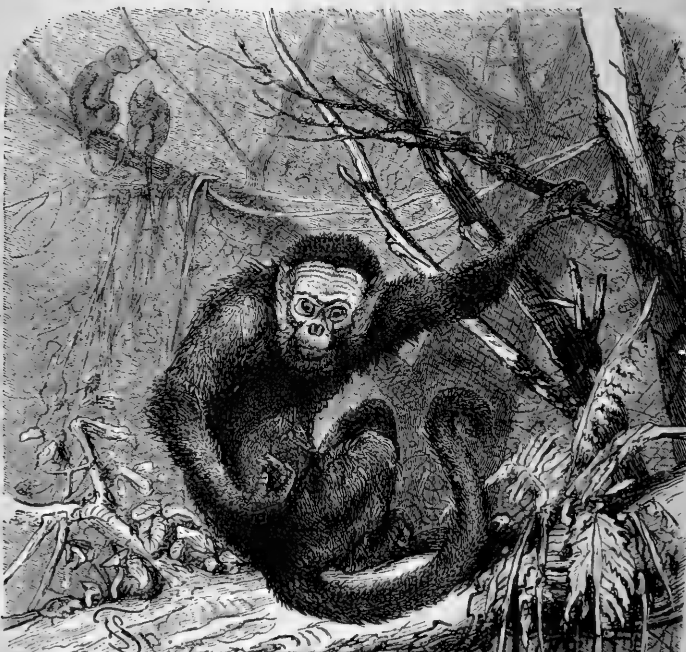

Fig. 30.—Capucin ape (*Cebus capucinus*).

sitional state. It can hardly be doubted that with most mammals the thickness of the hair and its direction on the back is adapted to throw off the rain; even the transverse hairs on the forelegs of a

dog may serve for this end when he is coiled up asleep. Mr. Wallace remarks that the convergence of the hair towards the elbow on the arms of the orang (whose habits he has so carefully studied) serves to throw off the rain, when, as is the custom of this animal, the arms are bent, with the hands clasped round a branch or over its own head. We should, however, bear in mind that the attitude of an animal may perhaps be in part determined by the direction of the hair; and not the direction of the hair by the attitude. If the above explanation is correct in the case of the orang, the hair on our forearms offers a curious record of our former state; for no one supposes that it is now of any use in throwing off the rain, nor in our present erect condition is it properly directed for this purpose." *

Darwin also remarks that it is erroneous to deny that apes have eyebrows. In fact, long bristly eyebrows are present in all anthropoids—not growing thickly together like those of men, but scattered among the shorter and thicker growth of hair which clothes the parts above the orbits; nor do they maintain any definite direction. In the white-handed gibbon, these eyebrows are remarkable for their length and stiffness. A growth of hair corresponding to eyebrows may, indeed, be observed above the upper eyelids of all mammals, including seals and pachydermata. On the upper lip of gorillas, chimpanzees, and orangs we may also observe a number of somewhat longer, stiff, and bristly hairs which stand apart from the otherwise short hairs on the lips, and give

* Darwin's *Descent of Man*, vol. i. p. 192.

the impression of a cat's "whiskers." In *Hylobates albimanus* I observed that these *vibrissæ* attain to a considerable length (Fig. 10).

The external form of the trunk of anthropoids, taken as a whole, does not greatly differ from that of man. We have not, indeed, the well-formed human torso, with its graceful lines; and the formation of the posteriors, together with a want of expansion about the hips, displeases us in its departure from the human type (see Figs. 1 and 6). We shall not be disposed to compare the torso of the Apollo Belvedere, or of the Olympian Hermes with that of a gorilla or chimpanzee. Yet the torso of a powerful male gorilla, from which the hair has been removed, may be favourably compared with that of one of the large-bellied, lean-armed weaklings who are everywhere to be found as living caricatures of the human species.

The neck of anthropoids is generally short and thick. In the gorilla that part of the body has a great backward convexity, owing, as we have said, to the great development of the spinous processes of the cervical vertebræ, and of the muscles attached to them. A short, thick throat, and considerable development of the neck, a bull-neck, as it is called, is also not unfrequent in man. This peculiarity is sometimes supposed to be one of the national characteristics of the African blacks. Burmeister says that "the negro's thick neck is the more striking, since it is generally allied with a short throat. In measuring negroes from the crown of the head to the shoulder I found the interval to be from nine

and a quarter to nine and three-quarter inches. In Europeans of normal height, this interval is seldom less than ten inches, and it is more commonly eleven inches in women, and twelve in men. The shortness of the neck, as well as the relatively small size of the brain-pan, and the large size of the face may the more readily be taken as an approximation to the simian type, since all apes are short-necked, and the relative distance of these animals is somewhat further from the negro than that of the negro from the European. This shortness of the neck in the negro explains his greater carrying power, and his preference for carrying burdens on his head, which is much more fatiguing to the European on account of his longer and weaker neck.*

Burmeister's assumption on this subject is, however, much too general. It does not apply to many of the negro races—at any rate, not to those of the Upper Nile valley. A long, thin neck is the characteristic of the Funje, Shillooks, Denkas, Baris, and other large tribes of those regions. Among these people the interval between the top of the head and the shoulder is from ten to eleven, and even from eleven to twelve inches (240 to 260 mm., and 260 to 286 mm.). Burmeister has been thinking exclusively of the Brazilian blacks. Yet I am unable to trace the typical short neck, either in the well-known portraits of slaves by Maurice Rugendas,† or in the collection of photo-

* *Geologische Bilder zur Geschichte der Erde und ihrer Bewohner*, ii. 120: Leipzig, 1851–53.

† *Voyage pittoresque dans le Brésil:* Paris, 1839.

graphs of Brazilian negroes which is in my possession. This characteristic is also absent, even in many portraits of West African and Mozambique blacks, tribes from which the slave population of Brazil has been chiefly drawn. Many Mongolians, Malays, Papuans, and Polynesians have short, thick necks, but this characteristic is more rare among the American aborigines and among Europeans. If we are to recognize an approximation to the simian type in this formation, it is one common to several nations, and it is not confined only, nor even chiefly, to the negro races.

The remarkable elongation of the upper limbs of anthropoid apes cannot be compared with the length of the corresponding limbs in men. For although among negroes and the members of other primitive peoples we may occasionally observe unusually long arms, yet these are individual peculiarities which are also found among Europeans, and cannot be counted among racial characteristics.

The hand of the orang and the gibbon is too long and narrow to be directly compared with the human hand. The chimpanzee and the gorilla, especially the latter, have hands more like those of man. In the case of an adult male gorilla the first glance at this member reminds us of the knotty fist of a black dock labourer or lighterman, like those who, at Rio de Janeiro, Bahia, or La Guayra, lift the heavy bags of coffee and place them on their heads or on their herculean shoulders. Much has been said of the enlargement of the connective skin between the bases of the fingers of a negro hand, and of the

pointed extremities of the fingers. Van der Hoeven, in his well-known treatise, *De Natuurlijke Geschiedenis van den Negerstam*, has described and drawn the hand of an Ashanti boy, formed in this manner.

Fig. 31.—Hand of a very aged male gorilla.

Hence there is a disposition to recognize in this peculiarity an important characteristic of the negro race. As in the hand of the gorilla, the connective web between the bases of the fingers is also extensive,

and the ungual phalanges taper at their extremities, there is also an inclination to ascribe an expressly anthropoid character to the negro hand. Yet this structure of the fingers is by no means universal

Fig. 32.—Hand of a Hammegh from Roseres, on the Blue Nile.

among the negroes. An enlargement of the connective web is not indeed uncommon, but its extent varies considerably. Nor is it wanting in the fingers of other races. An attentive observer will be able

to trace it in the labouring population of country districts in Europe. I have myself frequently observed this characteristic in Canton Wallis, and in the Lombard and Genoese provinces, through which I travelled on foot in 1869 and 1871, when I devoted special attention to this point. In Fig. 32 I give a negro hand of a type which seems to be common among the blacks in the inland districts of North-eastern Africa. It can hardly be denied that the form of this hand, which is certainly not flattered, possesses the characteristics of a thoroughly human organization.

With respect to other primitive peoples besides negroes, we have not at present sufficient information, and we ought therefore to beware of premature generalization. The thin shanks, with imperfectly developed calves, found among many primitive races, and especially among the African and Australian blacks, are often and not unjustly adduced as an instance of their ape-like formation. In fact, the general uncomeliness of these parts in the races in question is one of their significant characteristics.

The anthropoid foot resembles in structure those of other apes, including those of the New World, and as a rule it differs from the human foot in the flexibility of the great toes. It has, however, been justly observed that many individuals of different races have been able to use the great toe almost as if it were a thumb. Such persons may be found everywhere. Men who have been born without arms, or who have been deprived of them during life,

have been able to use their feet like hands, as some compensation for this privation. The most surprising instance of our time has occurred in the violinist without arms, whose performances are heard in various continental capitals. Another, mentioned

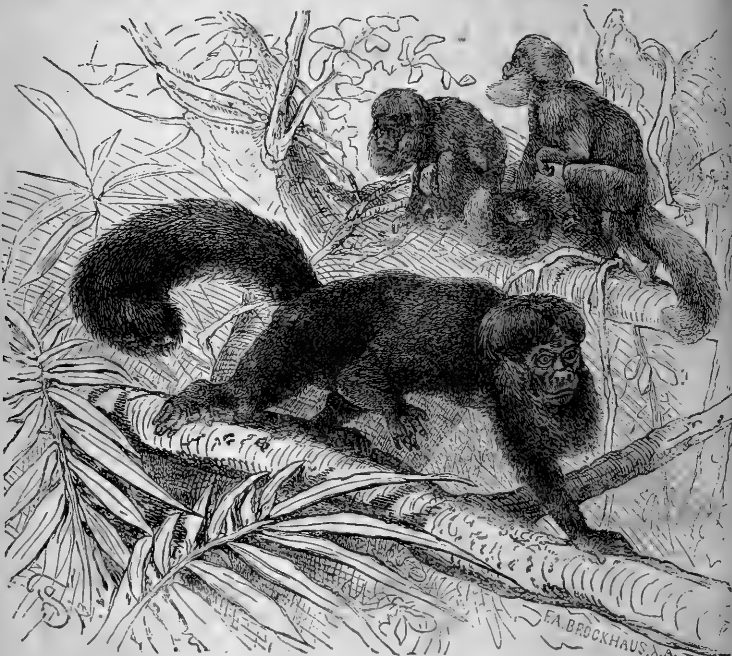

Fig. 33.—Satan's ape (*Pithecia Satanas*). Shows the formation and mode of using the feet in apes of the New World.

by Bär, was able to write with his feet. But even people who have the full use of their upper limbs can often grasp with the great toe as if it were a thumb, so as to pick up small objects from the

ground, or draw them towards them. Constant practice in such feats produces a certain dexterity. Negroes, Malays, Polynesians, and Indians make use of their outstretched great toes in climbing with as skilful a gripe as our schoolboys and sailors are also able to do in gymnastics, or in climbing up the masts. Among such people the distinction between the foot of man and apes is less marked, since, even when at rest, the great toe is apt to be somewhat detached from the others. This may be seen in A. Buchta's excellent photographs of individuals of the Central African tribe, the Makraka. Haeckel justly observes that there is no marked physiological distinction between the hand and foot which can be established on a scientific basis. In order to make such a distinction it is necessary to consider their morphological characteristics.*

Structure of the skeleton.—In comparing the skulls of anthropoids with those of men, we should, in the case of the gorilla, chimpanzee, and orang-utan, content ourselves with young specimens rather than with the skulls of adults. In aged apes of these species, the colossal development of the bony crests of the skull, as well as that of the jaws, the prominence of the orbital rim, and the flattening of the occipital bone, present distinctions of such a searching character that we are greatly hindered in the pursuit of the comparative method. But during the process of development the anthropoid skeleton admits of a direct comparison with that of man. In a young animal the rounded skull suggests a

* *Anthropogenie*, p. 482 : Leipzig, 1874.

parallel between it and the human head. It must be admitted that we find, especially in primitive peoples, many human skulls which in their whole plastic form differ little from the skulls of young

Fig. 34.—Human skull. *a*, Nasal bone. *b*, Upper jaw. *c*, Lower jaw. *d*, Occipital bone. *e*, Temporal bone. *f*, Parietal bone. *g*, Frontal bone. *h*, Malar bone.

gorillas, chimpanzees, and orangs. Even in the way the occipital bone is rounded off, young anthropoids and men are often found in a similar stage of development. The squamous occipital portion

in a young negro, Papuan and Malay, is indeed often flatter and more bevelled than it is in a young gorilla or chimpanzee.

We must not, however, assume that the two individuals brought into comparison are of precisely the same age, since such a point cannot easily be ascertained, even when subjects for examination are afforded by one of our larger museums. Savages are seldom able to give their precise age, and the attempt to do so often relies on insufficient data. The direct examination of the skull will afford some information on this point; but the conditions of growth in anthropoids are not so well known as to admit of an accurate estimate. We have to rely on the state of the teeth, on the stage at which the development of the bony crests has arrived, etc., in order to form an approximate estimate of the age of the skull.

On the squamous occipital portion the arrangement of the curved lines which are the boundaries to the attachments of the cervical muscles, is common to men, to anthropoids, and to other apes. Only indications of these lines are to be found in the lower order of mammals. In the human skull there is sometimes a formation belonging to the squamous occipital portion which has a distinctly pithecoid or ape-like character. This is the occipital swelling we have already described (*Torus occipitalis transversus*), which may be either enclosed by the two upper curved lines, or lie between these and the central curved lines, or may be altogether in the region of the latter. This swelling extends in a gradual manner

above and below its bony support. Its edge may be more or less sharp, more or less like a crest in its development, wider or narrower, with or without a central eminence, but its appearance is always striking. In young male and female gorillas, orangs, and chimpanzees this formation represents the completely formed transverse occipital crests, which are found for the most part in aged male animals of these species. These swellings may also be observed on the skulls of adult men of all times and all nations. They are by no means rare in the skulls which are in ordinary use at the Berlin School of Anatomy, and they are remarkably common in many groups of skulls. They are frequent among the skulls, for the most part without their lower jaws, which the late Dr. Sachs disinterred in a Mohammedan burial-ground of the thirteenth century, near Cairo. These are the remains of Mohammedans of different ranks, but, for the most part, of the peasantry or fellaheen. Ecker was able to trace the sagittal crest in the skulls of Australian males, while it is absent in the females. Similar indications of the bony crest have been observed by me in the roof-shaped or scaphocephalic skulls of many negroes, but in these cases I am not aware whether there is a corresponding distinction of sex. It can hardly be denied that this bony prominence is a human characteristic.

Broca has given the term pterion to the H-shaped connection formed by the sutures between the parietal bone, the greater wing of the sphenoid bone, the squamous portion of the temporal bone, and the

frontal bone. One of the most common disturbances in the symmetry of the connecting suture, as we have already briefly mentioned, arises from the insertion of a frontal process of the squamous portion of the temporal bone between the lower angle of the parietal bone, the fore-part of the frontal bone, and the greater wing of the sphenoid bone. This process of the temporal bone varies in size, and may occur on one or both sides. A similar formation is common among gorillas, chimpanzees, macacas, magots (*Inuus*), and baboons.* It is less frequent among orangs,† gibbons, marmosets, and American species (howlers, hooded apes, etc.).

Virchow and W. Gruber have agreed in representing this frontal process as theromorphological—that is, as a characteristic of the lower animals, and more especially of apes. Virchow has found this abnormal formation of the skull to be more common in some races than others. None of those in whom it occurs appear to belong to the Aryan races, and the existence of this process and stenocrotaphy, or temporal stenosis, seem to be due to a defective development of the greater wing of the sphenoid bone, and to the compression of the bones in its vicinity, by which the whole temporal region is contracted. This is a characteristic of the lower, but by no means of the lowest, races of men.

Stieda, Hyrtl, Gruber, and Calori have sought to

* It appears to be very common among Japanese apes (*Inuus speciosus*).

† Brühl has noted the intermittent occurrence of a connection between the greater wing of the sphenoid bone and the temporal bone.

controvert the fact that this temporal process is a characteristic of the lower races. Stieda asserts that it may occur exceptionally in all races of men.* He himself, aided by Anutschin, has ascertained the existence of this anomalous pterion on more than 10,000 human skulls, and he has also received information from others. He considers the frequency of this frontal process in man to be theromorphological, or indeed pithecoid. According to Anutschin, this anomalous condition is not equally common in all races. In the dark-skinned and woolly-haired races (Australians, Papuans, and negroes) the frontal process is most widely diffused; it is less frequent among Mongolians and Malays; and among Americans and white men its occurrence is from five to six times more uncommon than in the black races. Sometimes the frontal process occurs on the intercalary bone (*Ossa epipterica*), which is fused into the squamous portion of the temporal bone; and sometimes the process grows out of the squamous portion of the temporal bone. These imperfect processes or intercalary bones are not regarded by Anutschin as pithecoid, since they are more rare in apes than in men. Schlocker has sought to show that the frontal process of the squamous portion of the temporal bone, the less common temporal process of the frontal bone, and the temporal intercalary bone (*Ossa epipterica*) are of equal value from the genetic point of view.† This author regards the frontal process and

* *Archiv. für Anthropologie*, p. 121: 1878.

† Schlocker, *Ueber die Anomalien des Pterion.* Inaugural dissertation. Dorpat, 1879.

the immediate connection of the frontal and squamous portion of the temporal bones, as theromorphological characteristics, but he does not believe the occurrence of this process to be restricted to the lower races.* This is also the opinion of Ten Kate. However this may be, the establishment of this theromorphological formation is important. Its immediate value as a contribution to the theory of the origin of species remains, as we shall presently see, even if we cannot trace it through intermediate and lower types.

In the great prominence of the supra-orbital ridges which has been observed in some pre-historic human skulls, a likeness to the corresponding feature in anthropoids has been traced. And indeed there is such a likeness, especially to the female chimpanzee, in the well-known Neanderthal skull, which is very dolichocephalic, with prominent supra-orbital arches, only divided from each other by a shallow depression. In the same skull the development of the supra-orbital ridges is related to that of the frontal sinuses. In this pre-historic specimen—which, by the kindness of Professor Schaafhauser, I was able to examine closely at the congress of anthropologists at Berlin in 1880—the forehead retreats in a marked manner towards the flattened region of the crown. De Quatrefages and Hamy say that the skull is both flattened and long (dolichoplatycephalic). The temporal ridges are not only very marked, but they approach each other in the region of the coronal

* *Zur Kraniologie der Mongoloiden: Beobachtungen und Messungen*, p. 56. Dissertation. Heidelburg, Berlin, 1882.

arch (Fig. 35). This also occurs in the adult female chimpanzee, as well as in the young male gorilla, in the aged female orang, and in the gibbon.

It may here be observed that our men of science differ widely in opinion respecting the origin and ethnological significance of the Neanderthal skull, of which I will cite only a few instances. Pruner regards it as the skull of an idiot.* Virchow considers the specimen, and the similar one from Kailykke in the Copenhagen Museum, as an altogether individual formation,† a typical form modified by disease,‡ in other words, a pathological skull.§ King regards the skull as one belonging to one of the primitive races.|| Schaaffhauser has, indeed, endeavoured to make an artistic portrait of such a primitive man. Spengel holds that skulls which are "Neanderthaloid" in form are to be found chiefly in Europe.¶ Huxley says decidedly that the Neanderthal skull can by no means be regarded as the remains of a human being which was a link between man and apes. At most this discovery only proves the existence of a man whose skull reverted in some respects to the simian type, just as a carrier or tumbler pigeon may sometimes

* *Bulletin de la Société d'Anthropologie*, iv. fig. 305.

† *Verhandlungen der Berliner Gesellschaft für Anthropologie*, p. 164: 1872.

‡ *Die vierte allgemeine Versammlung der deutschen Gesellschaft für Anthropologie*, p. 49.

§ *Die Urbevölkerung Europas*, p. 46.

|| *Quarterly Journal of Science*, January, 1864. Comp. also Fuhlrott, *Der fossile Mensch aus dem Neanderthal*: Duisburg, 1865.

¶ *Archiv. für Anthropologie*, viii. fig. 63.

display the plumage of their original ancestor, the rock-pigeon (*Columbia livia*). And although the Neanderthal skull is more like that of the ape than any other human skull with which we are acquainted,

Fig 35.—The Neanderthal skull. A. In profile. B. A front view.

yet it is by no means so isolated as it at first appears, but is rather the ultimate expression of a series which may be gradually traced back from the

highest and most fully developed type of human skulls. On the one side it approximates to the flattened Australian skulls, from which other Australian forms gradually lead to skulls which rather resemble the type afforded by the Engis skull. On the other side, it is still more closely allied with the skulls of certain ancient races which were either contemporaries or successors of those which dwelt in Denmark during the Stone Age, people whose kitchen middens have been discovered in that country.*

Huxley justly observes that some of the skulls drawn by Busk, and taken from the tumuli of Borrely, resemble the Neanderthal skull, especially in the abruptly retreating forehead. Some other European skulls may, within certain limits, be compared with the Neanderthal skull, as, for instance, those found at Brüx, Staengenaes, Olmo, Louth, Clichy, Bougon, Cro-Magnon, Grenelle, Furfooz, Engisheim, Cannstadt, and Toul. These all present interesting peculiarities of structure—strongly developed supra-orbital arches, a retreating forehead, a flattened crown, etc., although none of them are so remarkable in these particulars as the Neanderthal skull. It has not, however, yet been proved that this skull represents a definite racial type, and it seems more probable that it was simply an individual form.

The skulls of the Australian aborigines are, as Spengel justly observes, distinguished from the Neanderthal skull, and from others of like character,

* *Zeugnisse*, etc., 157.

by their pronounced scaphocephalism. On the other hand, they have the prominent supra-orbital arches, the retreating forehead, the skull compressed in the temporal region, the prognathous countenance, relatively shorter than that of Europeans, and in all these respects the skulls of the Australians greatly resemble those of anthropoids. If, for instance, we turn to the illustration given by de Quatrefages and Hamy of a skull procured from Camp-in-Heaven, Arnhem's Land, North Australia, and also Dr. Schadenburg's negro skull, the most determined sceptic must be struck by their resemblance to the anthropoid skull.*

Similar characteristics to those which we have already mentioned as distinguishing the structure of the Australian skull, enable us to determine the anthropoid character of the skulls of many individuals belonging to the dark-skinned African races. These consist chiefly in the retreating forehead, the flatness and compression of the coronal arch, the pronounced prognathism, and the obtuse angles of the lower maxillary bones, which may be noted in so many negro skulls. On the other hand, the prominence of the supra-orbital arches is, as a rule, less marked in African races than in anthropoid species. There are specimens, however, as, for instance, the Congo skull given by de Quatrefages and Hamy,† which give an overwhelming impression of anthropoid characteristics. And we find the same to

* *Crania Ethnica*, plate xxvi.; *Zeitschrift für Ethnologie*, series 12, plate viii. fig. 2.

† *Crania Ethnica*, plate xxxvi.

a surprising degree in the skulls of intelligent, warlike, and light-skinned races of Central and Western Africa, and as the Monbuttre, Haussaua, Bakale, Fan, etc. This character may be discovered in all races of men, and especially among the Papuans and some African negroes.

A mutual approximation of the temporal ridges in the coronal region may be observed in the skulls of various nations. This formation is most frequent in the long-headed negro and Papuan skulls. In these cases it is generally allied with the shortness of the interval between the sides of the skull, taken in its transverse diameter (stenocephalism).

In an adult female chimpanzee, the parietal bones often rise abruptly towards the sagittal suture, and in its vicinity there arises a longitudinal bony prominence, of which the sides pass gradually into the external surface of the parietal bones. The sagittal suture sometimes remains intact, and is sometimes included by this process. This produces a modified development of the so-called keel-shaped skull (*scaphocephalus*). Such a formation may be often observed in negroes and Papuans, and more rarely in the skulls of other races. The occurrence of a divided malar bone in human skulls, especially in those of the Ainos and Japanese, has been considered to be theromorphic, since it is occasionally observed in the skulls of apes.* I have

* Ten Kate, *loc. cit.* pp. 17, 42. Virchow is of opinion that the facts are not sufficiently clear to enable us to judge how far this formation affects men (*Monatsbericht der Akademie der Wissenschaft zu Berlin*, p. 258: 1881). The detachment of the

myself, in a very few instances, found obscure traces of such a formation among anthropoids.

In 1863 Boucher de Perthes found at Abbeville half of a human lower jaw deposited in a black layer of clay and sand mixed with iron, and lying on the chalk. As far as we can judge from illustrations which are for the most part imperfect, there was nothing remarkable about it except its abruptly retreating ramus (Fig. 36), but the specimen aroused great attention at the time, and it was assigned by

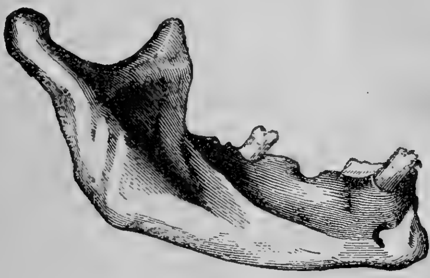

Fig. 36.—Lower jaw of Moulin-Quignon.

many intelligent observers to the primitive men of the diluvial period. Unfortunately it was afterwards proved to be a gigantic imposture.*

This is not the case with the lower jaws of Naulette, Aurignac, and Arcy, which are undoubtedly genuine and of great antiquity. The Naulette jaw is, indeed, very imperfect, yet we can trace the construction of the symphysis of the chin,

malar bone from the spheno-maxillary fissure of the orbit has up to this time been too rarely observed in anthropoids to merit serious consideration in this work.

* Joly, *Man before Metals:* London.

which provokes comparison with the lower jaws of many anthropoids, especially those of the gorilla and chimpanzee (Fig. 37). The resemblance consists chiefly in the uprightness of the anterior surface, and especially of the body of the maxillary bone.

Fig. 37.—Naulette lower jaw.

In anthropoids this surface of the bone retreats from the row of teeth backwards and downwards to the lower edge of the body of the maxillary bone (Fig. 38); and in the Naulette specimen, as well as in the lower jaws of some modern Papuan skulls (of

Fig. 38.

New Hebrides and elsewhere), there is a certain approximation to the simian type. A fossil ape (*Dryopithecus Fontanii*) has been found in the Middle Miocene of Saint-Gaudens, assumed to be one of the higher anthropoids, and in this case the jaw is only

slightly retreating. Gaudry considers that the *Dryopithecus* was about the size of a man. The incisor teeth were small. The cusps of the back molar teeth were less rounded than in Europeans, and more like those of Australians. It has been surmised, although the fact cannot be established, that the last molar teeth were only cut after the canine teeth, as is the case with the human wisdom teeth. Gaudry gives the illustration of the lower jaw of a Tasmanian, from eleven to twelve years old, together with that of *Dryopithecus Fontanii.* In the human jaw the first molar tooth is larger than in the *Dryopithecus,* while the canine tooth and the pre-molars are much weaker. This distinction is important, since the smaller size of the front teeth is connected with the slight projection of the face, which is always a sign of human superiority. Although the canine tooth of the *Dryopithecus* is broken, we can see that it must have been considerably higher than the other teeth, and indeed the canine teeth of the male animal must have been very powerful. There is also a slight prominence in the teeth of this ape, which is absent in those of men. *Mesopithecus,* from the Miocene of Pikermi, Attica, was an ape less closely resembling the anthropoids. In the structure of the head it resembles the slender ape (*Semnopithecus*), and in the structure of the limbs it is like a macaca (*Macacus*). Gaudry believes that Sansan's *Pliopithecus* was related to the gibbon. An ape of the size of the orang-utan, which belongs to the slender apes (*Semnopithecus sub-himalayanus*),*

* Gaudry, *Les enchainements du monde animal,* p. 232: Paris, 1878.

was found by Baker and Durand in the Miocene of the Sewalik mountains.

In the comparative study of the human organization, and that of anthropoid apes, it is important to examine sections, and especially longitudinal sections, of characteristic skulls.* Virchow has caused drawings to be made, from specimens in the Berlin Museum, of a gorilla, a chimpanzee, an orang-utan, and an Australian woman. The gorilla's skull, when compared with the Australian's, is so narrow that it looks as if compression had been applied to it; and yet the Australian skull is extremely small in comparison with that of men in general, since its cubic space is only 1150 ccm. In the gorilla †—at least in the old male, from which the drawing is taken—the immense size of the frontal sinuses, and the swellings which cover them, together with the strongly developed jaw, increase the impression of size. But, as Virchow observes, "all which adds to the size of the skull is bestial, and not human." It is much the same in the orang-utan. Only in the chimpanzee the cubic space of the skull may be somewhat more favourably compared with that of the human skull. It approaches in size to that of a microcephalic native of the Rhein-Pfalz (of which an illustration is also given), which ranks a good deal below the Australian skull, and approximates more closely to the simian type. The internal space of the skulls of an adult female gorilla or orang

* Hartmann, *Der Gorilla*, pp. 68, 109.

† *Correspondenzblatt der Deutscher Anthropologischen Gesellschaft*, p. 148, with illustration: 1878.

may also be more favourably compared with those of men.

We have already mentioned the presence of extensive sinuses and cells in the skulls of anthropoids, exceeding those of human skulls, and this is apparent in the accompanying illustration of a longitudinal section of the skull of a chimpanzee carried through its centre (Fig. 39). The length of this skull between the nasal partition and the most prominent part of the occipital bone is 128 mm.; that of the internal space is 108 mm. 10 mm. of this difference is due to the depth of the

Fig. 39.—Sagittal section through the skull of a bam-chimpanzee.

frontal sinuses, and the rest is owing to the thickness of the bony part of the skull. In an aged male gorilla, the first measurement is 153 mm., the second 115 mm. In another aged gorilla the measurements were respectively 183 mm. and 117 mm. In a still more aged male orang they were respectively 140 mm. and 114 mm. The comparative thinness of the centre of the squamous occipital portion is to be noted in the aged gorilla male. In the adult chimpanzee the large cells of the squamous portion

of the temporal bone extend into this bone, and indeed without interruption into the parietal bone adjoining it. For such investigations the thin and light bones of individuals which have lived a wild life are more suitable than the heavy and fat specimens which have died after prolonged confinement.

Zuckerkandl has observed that among Europeans the orbital part of the nose, or that part which is between the orbits, is longer than the infra-orbital or lower part. In anthropoids the infra-orbital portion is considerably the longest, although only in adult animals. There are stages in the period of development in which these animals display the characteristics of an adult European, or indeed of a child. The proportions of the skulls of Malays take a middle place between those of Europeans and of apes. The growth of the infra-orbital part of the nose in the Malay does not equal that of apes, but in many cases it differs essentially from that of Europeans. Zuckerkandl makes a skilful attempt to establish this statement by statistics.

The same inquirer makes some interesting remarks on the comparative height and width of the orbits. He observes that the skulls of adult apes and men differ more in these respects than the young specimens of these organisms. The orbits both of a child and an adult, especially in the case of a European, are much more like those of a young ape than of an aged animal of the same species. In the chimpanzee and the orang-utan the proportions are the same as in men; that is, the width

of the orbit exceeds its height. In man, this seems to arise from the exceptionally strong development of the supra-orbital ridge. It is most probable that in very young anthropoids the width of the orbit exceeds its height.* Zuckerkandl goes on to say that in anthropoids the height of the orbits is greater than their width, and that this difference increases with age. But this is not absolutely correct, for even in aged animals the proportions vary, and the height and width of the orbits sometimes, although rarely, remains the same.

In comparing the vertebral column in men and anthropoids, Rosenberg has sought to show in the embryo, that the first sacral vertebra assumes the form of a lumbar vertebra, and that in a later stage of development it is enclosed by the ilia, and anchylosed with the sacrum. The same author has proposed a theory of the homologous or genetic equivalents of the vertebræ, which we must now consider. According to this theory, as Welcker has observed,† the twentieth vertebra of an animal A is homologous to the twentieth vertebra of an animal B, the thirtieth vertebra of one animal to the thirtieth of another, although in one case it may be a lumbar vertebra, in another a pelvic vertebra, and in a third a coccygeal vertebra. The dorso-lumbar vertebræ of the lower apes have, in the case of men, their descendants, undergone a threefold metamor-

* *Zur Morphologie des Gesichtsschädel*, pp. 73, 85, 89: Stuttgart, 1877.

† Welcker on His und Braune, *Archiv. für Anatomie*, 1881. Rosenberg, Gegenbaur's *Morphologisches Jahrbuch*, i. 172.

phosis, and, after their modification into sacral vertebræ, have assumed their fourth form as coccygeal vertebræ.

Froriep, a follower of Rosenberg, remarks that the lumbo-sacral vertebræ, *i.e.* those constituents of the vertebral column which form the transition from the lumbar to the sacral vertebræ, are invested with fresh interest by Rosenberg's hypothesis. According to their position in the vertebral column, they are to be regarded as lumbar vertebræ, introduced too early or too late into the structure of the sacrum. If the twenty-fourth vertebra is assimilated with the sacrum, so as to form an upper promontory or outwork, this variety offers a point of transition to a future formation (?) in which this vertebra normally becomes the first sacral vertebra, and the column will now display twenty-three free vertebræ. If, again, this transition occurs in the twenty-fifth vertebra of the series, which thus becomes the chief sacral vertebra, this is, in Rosenberg's opinion, a characteristic survival of the racial development, an atavism.*

According to Welcker's theory, the chief sacral vertebra in one animal corresponds to the same sacral vertebra in another animal, whatever their number may be. The cervical vertebræ of one animal, which may be five, seven, or even eleven in number, correspond to the cervical vertebræ of another animal. The vertebral column of one animal corresponds to the vertebral column of another, taken as a whole, but not to two-thirds or three-fourths of that column. In accordance with

* *Beiträge zur Geburtshülfe*, p. 161.

the requirements of a given animal, that part of the bone which belongs to the sections of the breast and loins is more or less abundant, and the vertebræ are homologous in accordance with their region, and not with their number.

Holl has asserted that one vertebra is in close connection with the ilium, joined with it throughout its extent, and that this vertebra at the same time always appears to support the pelvis. This vertebra is, in normal cases, the first sacral vertebra, and the twenty-fifth of the series. It may be termed, as Welcker suggests, *vertebra fulcralis.* Such a main support is found, according to Holl, in every vertebral column, however anomalous its other conditions may be, and the only irregularity consists in its number in the series. This bone serves as a natural starting-point in our division of the vertebral column. The *vertebra fulcralis* must always be regarded as the first sacral vertebra. It begins the series of sacral vertebra, and, on account of its subsequently important position, it must be regarded as primary. Holl finds that it is followed by four lower vertebræ, which are afterwards included with it in the sacrum. When in its primary condition the *vertebra fulcralis* is tw nty-fifth in the series, the twenty-fifth to the twenty-ninth vertebræ are included in the sacrum. When the *fulcralis* is the twenty-sixth vertebra, the sacrum includes the thirtieth. Hence it follows that the sacrum is, from the first stages of its development, a formation which begins with the twenty-fifth or twenty-sixth vertebra, and includes four other vertebræ. Holl considers that the lumbo-

sacral form of the last lumbar vertebra, which stands between the lumbar and sacral vertebræ, does not indicate a gradual transition into a sacral vertebra, but rather an arrest in its development.*

When we examine a human sacrum we see that its first vertebra, the twenty-fifth of the series, is formed like the lumbar vertebræ in its upper part, setting aside those portions of it which form part of the lateral masses of the sacrum. These lateral masses, which serve as a support to the ilia, owe most of their substance to the first sacral vertebra. Thus, since it has to support the whole weight of the presacral vertebræ, it is in fact a true *vertebra fulcralis.*

Holl justly says that there are few instances in which the human *os sacrum* consists of less than five vertebræ, and in no case are there less than four. In such a case the first sacral vertebra defines the pre- and post-sacral segment of the vertebral column.

In anthropoids the lower segment of the lumbar vertebral column is deeply sunk between the high, wide, and flattened ilia, which converge closely towards the vertebral column. In man these bones are not so much higher than the base of the sacrum, and their crests diverge more widely from the vertebral column. In the large apes the lateral masses of the sacrum are comparatively deeply set below their anchylosis with the pelvic bones. In an aged male gorilla, for instance, the transverse processes of the two lower lumbar vertebræ often extend to the

* *Sitzungsberichte der Akademie der Wissenschaften zu Wien,* lxxxv. fig. 1.: 1882.

hinder borders of the ilia, although the second of the lower lumbar vertebræ is somewhat higher than the top of the crest of the ilium. This is still more remarkably the case in an old male chimpanzee, in which the lowest lumbar vertebra seems to be wedged in between the two ilia. In a young male chimpanzee, and in the adult female, both the lower lumbar vertebræ are almost compressed between the upper segments of the ilia. In the orang the lowest lumbar vertebra is placed between the ilia. Out of the five sacral vertebræ the first and second are articulated with these bones.

In the gorilla the highest sacral vertebra, the twenty-fifth of the series, is the *fulcralis*. In this animal the first to the third sacral vertebræ form part of the connection with the crests of the ilia. In the chimpanzee the twenty-fifth is also the *vertebra fulcralis*, and from the first to the third are likewise connected with the ilia, but the third only to a limited extent; and in young males and in old females the connection is generally confined to the first and second sacral vertebræ. In the orang-utan the twenty-fourth vertebra is generally the *fulcralis*.

In the gibbon the twenty-fifth vertebra is usually the *fulcralis*. In the siamang I found that the fifth of the five lumbar vertebræ was between the ilia. Out of the five sacral vertebræ the first and second were articulated with the said pelvic bones. In *Hylobates agilis* the fifth and sixth of the six lumbar vertebræ were between the ilia, and the first and second of the five sacral bones were articulated with these.

In the vertebral columns of the gorilla, the chimpanzee, and the orang we may observe an inconsiderable forward projection between the penultinate cervical and the second and third dorsal vertebræ. In the region below the second lumbar vertebra a similar forward projection may sometimes be observed. The so-called promontory at the entrance of the pelvis, that is, in the region developed between the lumbar and sacral vertebræ, which is remarkable in man, is only faintly apparent in anthropoids. The vertebral column is arched behind, since there is a dorsal curvature (see Figs. 17 and 23).

Aeby observes that the bodies of the vertebræ are tapering in the gorilla, and this is, in fact, the case. In climbing, or when he goes on all fours, the dorsal curvature of an anthropoid maintains its position. This curvature is still more apparent when the animal, in climbing, withdraws his body from the tree, mast, or whatever it may be, and bends forward his head. A similar dorsal curvature of the vertebral column may be observed in men who stiffen their hands and feet to climb up a tree or mast. If an anthropoid holds himself so erect as to be able to place his hands behind his head, the dorsal curvature of his spine is necessarily straightened, and indeed it becomes rather a ventral curvature.

The bony pelvis of anthropoids, with its high, narrow, and projecting ilia, and the lowest lumbar vertebræ deeply embedded between them, together with the sacral and coccygeal vertebræ, which directly remind us of the vertebræ of a rudimentary

tail, present the points of unlikeness with the human skeleton in this part of the skeleton of these animals in the strongest light (comp. Figs. 40 and 41).

The bony thorax of anthropoids is distinguished from the human thorax in normal cases by the abrupt way in which it widens outwards. The thorax of the gorilla, and the widely diverging pelvic bones, which enclose the belly and give it a tun-shaped form, contrast with the graceful moulding of the corresponding parts of the human form.

Certain peculiarities in the structure of the bones of the shoulder-girdle and of the extremities of anthropoids, in which they differ from corresponding parts in the human structure, have been already mentioned.

With reference to the humerus of the gorilla, Aeby asserts that the head of the bone forms a cycloid, placed transversely, while in man its shape is that of the segment of a sphere. But I have pointed out in my treatise on the gorilla that there is a not inconsiderable variation in the form of the head of the humerus in these animals, and it is sometimes cycloidal or vertically-cycloidal, sometimes a segment of a true sphere. In the chimpanzee, orang, and gibbon this part of the humerus is always a segment of a sphere, while in man its form is not equally invariable. Aeby further observes that the transverse-cycloidal form of the head of the humerus in the gorilla justifies the inference that this animal, in the use of its fore-limbs, is accustomed to turn them transversely on their axis. But the direct observation of a living anthropoid, as

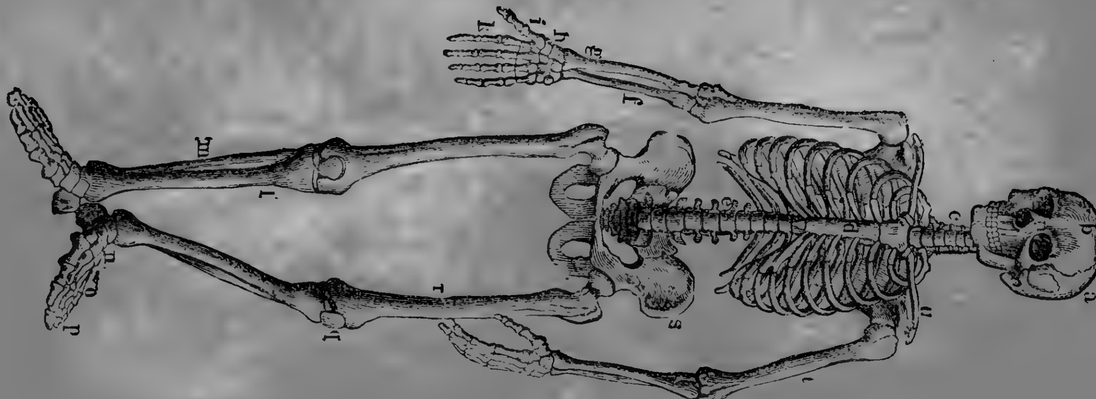

Fig. 40.—Human skeleton.—*a*, Parietal bone. *b*, Frontal bone. *c*, Cervical vertebræ. *d*, Sternum. *e*, Lumbar vertebra. *f*, Ulna. *g*, Radius. *h*, Carpus. *i*, Metacarpus. *k*, Phalanges. *l*, Tibia. *m*, Fibula. *n*, Tarsus *o*, Metatarsal bones. *p*, Phalanges. *q*, Patella *r*, Femur *s*, Os innominatum. *t*, Humerus. *u*, Clavicle.

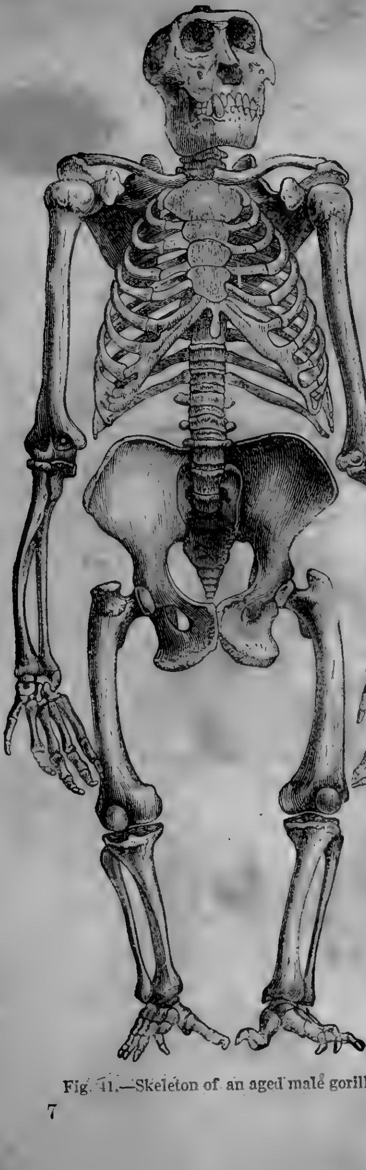

Fig. 41.—Skeleton of an aged male gorilla.

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well as the examination of its dead body, make it clear that the action of the ball and socket is remarkably free, and this theoretical surmise is contradicted by the perfection of the natural mechanism.

The excessive curvature of the forearm which we notice in the gorilla and the chimpanzee in their natural condition is rare in man, and when it does occur it must be regarded as an abnormal and pathological phenomenon.

The orang-utan always displays a ninth carpal bone, corresponding to de Blainville's *os intermedium* and Gegenbaur's *os centrale carpi.* In a very young animal I found that this small bone was furnished with a peculiar point of ossification. The bony structure of the wrist is developed in the following succession:—First, the *os magnum* and unciform bones; second, the scaphoid bone; third, the trapezium; fourth, the semi-lunar bone; fifth, the cuneiform bone; sixth, *os centrale carpi;* seventh, the trapezoid bone. The pisiform bone and the sesamoid bone, between the trapezium and the scaphoid bone, of which we shall speak presently in their relation to the muscular system, are at first simply cartilaginous.

Up to this time my search for this ninth carpal bone in the gorilla and the chimpanzee has been fruitless, since its occurrence is only exceptional. In the gibbon it is plainly inserted between the scaphoid, semi-lunar, trapezoid, and *os magnum.* Gegenbaur considers the *os centrale* to be a true constituent of the wrist, dating from an earlier condition, but he has nothing to suggest as to its subsequent survival.

Rosenberg has lately given an incontestable proof of the presence of this bone in the human embryo. It is generally absorbed again, but sometimes it persists, and may be found in an adult as a well-formed ninth carpal bone. Cases of the persistence of the *os centrale* in man have been chiefly collected and published by the diligence of the Russian anatomist, Gruber. It is now suggested that there may also be indications of *os centrale* in the carpus of embryos of the gorilla and chimpanzee, but up to this time materials for such researches have been wanting.

I cannot accept the theory that *os centrale carpi* is merely a detached portion of the scaphoid bone. In a very young chimpanzee this bone is undoubtedly superficially indented with two transverse furrows, but the three segments display only one uniform development of bone. The distinct formation of *os centrale,* and its occasional appearance in man, testify that it has an independent existence. Rosenberg holds that this bone is not merely the *os centrale* of mammals, but that it is homologous with the two *ossa centralia* of the fossil *Enaliosauria.* It has become abortive in proportion to the reduction in size which has taken place.* There would be no great difficulty in tracing back this bone to remote types of vertebrate animals, even as far as the *Urodela* (Wiedersheim) of Eastern Asia.† The persistence of this bone in man must be regarded as a reversion, not as an arrest, of development.

* Hartmann in *Archiv. für Anatomie,* etc., by Reichert and Du Bois-Reymond, pp. 639–643 : 1876.

† Wiedersheim, *Morphologisches Jahrbuch*, ii. 421.

On the femur of several mammals, especially in the horse, ass, rhinoceros, and tapir, and more slightly indicated in the carnivora and other families, there is, in addition to the two great and small trochanters, a third, termed by Waldeyer *trochanter tertius.**

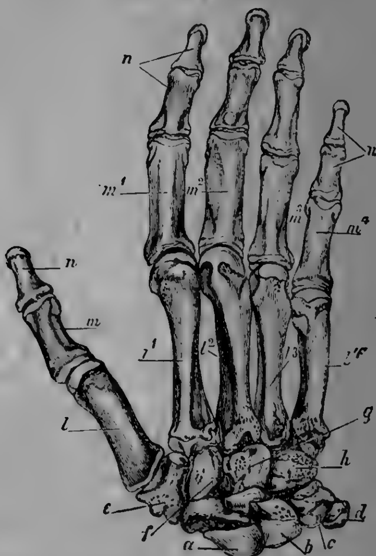

Fig. 42.—Skeleton of human hand, back view. *a*, Scaphoid bone. *b*, Semi-lunar bone. *c*, Cuneiform bone. *d*, Pisiform bone. *e*, Trapezium. *f*, Trapezoid bone. *g*, Os magnum. *h*, Unciform bone. *l-l*, Metacarpal bones. *m-m'* and *nn*, Phalanges.

Such a formation, low, blunt, and generally placed at the top of the outer ridge of the superior bifurcation of the *linea aspera*, may be observed in human skeletons of all races, but is either absent in anthropoids or only faintly indicated. Virchow justly

* *Archiv. für Anthropologie*, p. 463 : 1880.

regards its presence as theromorphic, but not as a characteristic of savage or lower races.*

The human tibia displays in some instances a compression or lateral flattening of its shaft or centre-piece, so that its transverse diameter is quite out of proportion to its depth. Such a tibia is termed sword-bladed, or platycnemic. Bones of this form have been chiefly discovered in ancient deposits, as, for instance, at Gibraltar, at Perthi-Chwareu, in Wiltshire, in Lozère, at Clichy, at Saint-Suzanne (Sarthe), and especially at Cro-Magnon (Fig. 43), Janischwék, etc.

A similar formation has also been observed among men belonging to cultured races, both of ancient and modern times. Virchow, for example, discovered such bones in Transcaucasia (of the third and fourth century of the Christian era) and at Hanai-Tepe in Troas. All the large schools of anatomy in Europe contain specimens of tibiæ, which are to some extent platycnemic. These are also observed in the skeletons of primitive peoples of our time, as for example in the Negritos, Kanakas, and other African races. While some scientific men regard these bones as the result of an unhealthy condition, and the effect of rachitis, others more justly ascribe them to a vigorous exercise of the muscles in a one-sided direction. The idea expressed by Busk and others, that the platycnemic tibiæ discovered in ancient sites of Europe have belonged to a degraded race diffused over the whole continent,

* *Alttrojanische Gräber und Schädel. Aus der Abhandlungen der Königl. Akademie der Wissenschaften zu Berlin*, p. 47 : 1882.

is contradicted by the wide diffusion of this characteristic, even in modern times. And it is doubtful whether platycnemy is absolutely restricted to the lower races. At Janischewek, Virchow found an extremely platycnemic tibia, exhumed from a kujawish grave of the Stone Age, which belonged to a skull remarkable for its unusual beauty and size, so that, taken by itself, the impression which it gave to an anatomist was that of a highly organized race.*

It is important to remark that platycnemy has

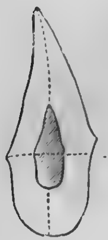

Fig. 43.
Section through a platycnemic tibia from Cro-Magnon.

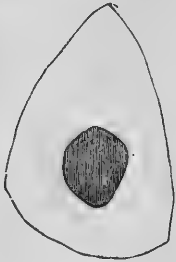

Fig. 44.
Section through the tibia of a male gorilla.

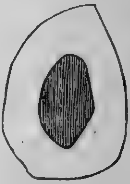

Fig. 45.
Section through the tibia of a male chimpanzee.

been regarded as a pithecoid structure, and for this reason the attempt has been made to establish the degraded position of those peoples which are most remarkable for platycnemy. But, as Boyd-Dawkins has already observed, although the tibiæ of the gorilla and the chimpanzee are to some extent platycnemic, they are much less so than the platycnemic bones of the human skeleton. The tibia of

* *Sitzungsbericht der Berliner Anthropologischen Gesellschaft:* April 17, 1880.

a male gorilla in the College of Surgeons Museum has an index width of 68·1, that of a female of 65·0, while the index of the chimpanzee's tibia is 61·1, which is about the average of the tibias of Perthichwareu. It is unnecessary to indicate the other marked distinctions between the tibiæ of men and apes; if platycnemy is to be regarded as genetic, it must be admitted that man has in this particular far exceeded apes.* Neither the gorilla, the chimpanzee, the orang-utan, nor even the baboon possesses a tibia which is flattened in its upper or middle part. In all these apes the middle of the bone is more or less rounded, almost as if it had been rounded by a turning-lathe. According to my experience, the degree of platycnemy in anthropoids is subject to certain variations. It appears to me to be least marked in the aged male gorilla (Fig. 41), and in the gibbon (*Hylobates agilis, syndactylus*), in which latter animal the transverse section of the tibia represents an almost equilateral triangle. The platycnemy was more marked in an almost adult female gorilla, still more decided in an aged male chimpanzee, which came from the river Kiulu, and again in an aged female chimpanzee. On the other hand, the centre of the shaft of the tibia in another aged male chimpanzee which came from Loango, was rounded, and not platycnemic. In the tibia of an adult orang-utan which I examined, the platycnemy was very marked. But I agree with Boyd-Dawkins in never having met with an anthropoid in which the platycnemy is so considerable as it is,

* See Spengel's *Caves and Primitive Inhabitants of Europe.*

for instance, in the Cro-Magnon tibia, and in another found at Troy.

If we give a cursory glance at the lower limbs of apes, we see that all the same characteristics are present in their tarsus that we find in the human tarsus. In each case there is an astragalus, an *os calcis*, a scaphoid bone, three cuneiform bones, and a cuboid bone. There are undoubtedly several peculiarities in which the tarsus differs from the corresponding part of the human foot. The first metatarsal bone is joined to the first cuneiform bone by an articular facet which extends from the back to the sole of the foot. This joint plays a part resembling that of the thumb of the human hand (see Figs. 20 and 46).

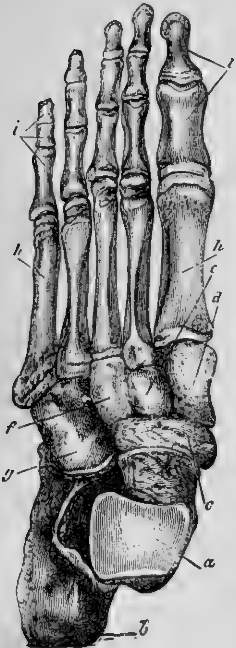

Fig. 46.—Skeleton of the human foot, seen from above. *a*, Astragalus. *b*, Os calcis. *c*, Scaphoid bone. *d, e, f*, Cuneiform bones. *g*, Cuboid bone. *h*, Metatarsal bones. *ii*, Phalanges.

In Huxley's opinion, the hinder limbs of the gorilla terminate in a true foot, with a very movable great toe. It is undoubtedly a prehensile foot, but in no sense a hand. It is a foot which does not differ from the human foot in any essential characteristics, but only in relative circumstances, in the degree of flexibility, and in the subordinate

arrangements of its parts. Huxley adds that it must not be supposed that he wishes to undervalue differences which, however, he does not regard as fundamental. They are important enough of their kind, since in any case the structure of the foot is in close correlation with the other parts of the organism. Although it cannot be doubted that the increased division of labour in man, which relegates the function of support entirely to the legs and feet, is a significant advance in structure; yet, regarded as a whole from the anatomical point of view, the points of agreement between the human foot and that of the gorilla are much more striking and significant than their differences.

The differences in the foot of the orang are still greater; in the very long toes and short tarsus, the short great toe and the removal of the heel from the ground, in the great obliquity of the joints which connect the foot with the shank-bones, and in the absence of a long flexor muscle to move the great toe, the orang's foot differs still more from that of the gorilla than the latter differs from the human foot. In some of the lower apes the hands and feet are still further removed from those of the gorilla than in the case of the orang. In the American apes the thumb can no longer be opposed; in the ateles it is reduced to a mere rudiment, covered with skin; in the sahius it is bent forwards and provided with a curved claw like the other fingers. In all these cases there is no doubt that the hand differs more from that of the gorilla than the gorilla's hand differs from that of man.*

* *Manual of the Anatomy of Vertebrated Animals*, p. 481: London, 1871.

Flower remarks that the chief distinction between the foot of a man and an ape consists in the fact that the latter is transformed into a prehensile organ. The tarsal and metatarsal bones, and the

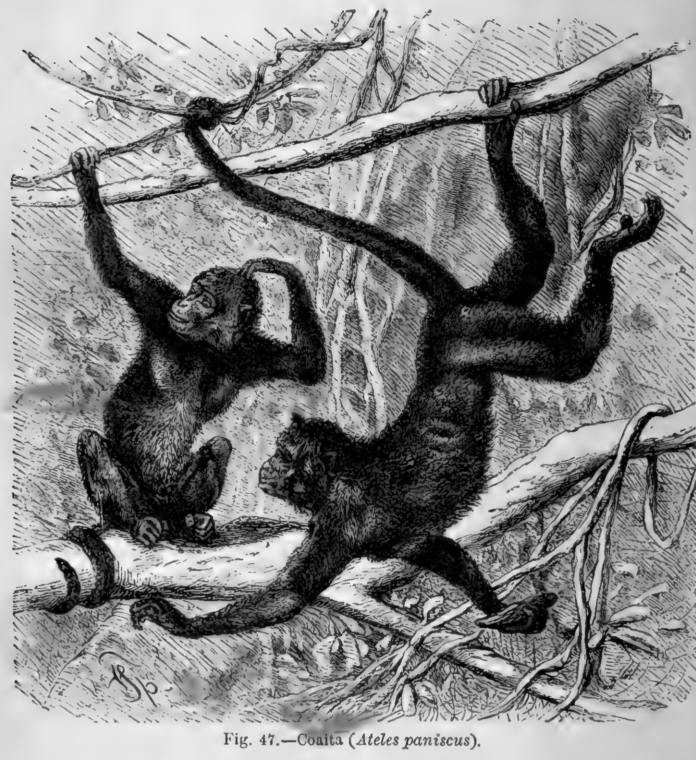

Fig. 47.—Coaita (*Ateles paniscus*).

phalanges are of the same number in both orders, and in the same relative position, only in the foot of the ape the facet for articulation of the first cuneiform bone with the great toe is saddle-shaped, and

obliquely directed towards the inner or tibial side of the foot. Thus, the great toe is separated from the others, and so placed, that when it is bent, it is directed downwards towards the sole, and is opposed to the other toes, much more opposed to them than is the case with the thumb of the human hand.* Owen also speaks of the characteristic transformation of the great toe of an ape's foot into a thumb, opposed to the other toes, and adapted for grasping.†

K. E. von Bär does not agree with Huxley in considering that there is less difference between man and the gorilla than that which exists between different species of apes. "There are," Von Bär remarks, "differences of various kinds among apes. In some the thumb is only a stump; in others, as in the orang-utan, the fingers of the hinder extremities are so long and curved that they cannot be extended on flat ground; in many of the smaller apes this member is still more like a hand than in the larger species, and the fingers can be easily spread out on the ground. In this case the foot is of a much blunter form, and is more flexible, so that the sole, which is properly turned inward, can lie flat on the ground. The heavier the body of the animal, the more sharply cut the structure of the foot must be, so that it does not admit of the free movements which are possible in the hand. But all these are only modifications of a climbing foot,

* *An Introduction to the Osteology of the Mammalia*, p. 310: London, 1870.

† *On the Anatomy of the Vertebrates*, ii. 551. Also see my own works in *Archiv. für Anatomie*, p. 648: 1876.

or prehensile member—that is, of a hand, not modifications of a foot resting firmly on the ground and supporting the whole weight of the body.

"It must not be forgotten that the structure of the skeleton is subject to mechanical laws, which may be traced through the whole series of the animal world. This is readily apparent when we turn to the human structure.

"The human foot rests for the greater part of its length on the ground, that is to say, with the heel and centre of the foot, which form together a firm arch. The tarsus consists of the astragalus, and also of the *os calcis,* which in man form a very prominent part, taking a backward and downward direction, and of five other bones. The metatarsus consists of five bones, on which the five toes are inserted. In man these metatarsal bones are considerably longer than the separate phalanges. Thus, the arch on which man is supported in an erect position extends from the heel to the extremities of the metatarsal bones. The several bones are slightly movable, but they are so firmly connected that they can diverge but little from each other, unless muscular power is exerted. In order to press the toes upon the ground, it is again necessary to exert the muscles. The arched instep has this advantage, that the foot can take a better hold of the slight inequalities of the ground. In a profile view of the skeleton of a human foot, the shortness of the toes, in comparison with the length of the arched instep, is very apparent. In any natural position, even when man is not walking or standing,

the sole of the foot is not turned inwards, but downwards. . . . The toes of the gorilla take the form of a hand, since the great toe stands separate like a thumb, while the other toes are turned outwards. In the gorilla the tarsus is short, and the heel is bent inwards. The several bones of the human foot are undoubtedly present in the hind hand of a gorilla, but the organ is changed into a prehensile organ or hand. The conditions are the same as in the parts of the mouth in insects which in some cases form movable mandibles, while in others they are attenuated into a proboscis. When it is asserted that apes are not quadrumanous, it is as if we were to say that flies have no proboscis, but attenuated mandibles." *

All apes, including anthropoids, occasionally make use of their hinder extremities in order to snatch at objects. They also grasp with them in climbing. On such occasions, when they wish to secure the fruit they have seized from the voracity of their fellows, they take it between the toes of one hinder extremity, in order to be able to get away more quickly by means of the other, and by the use of both hands.

From what we have said, it will be seen how difficult it is to reconcile the views of different observers with respect to the fitting term to be given to the hinder extremities of apes. Against those who uphold the designation of *hind hands* we must oppose the anatomical structure, and also the

* *Studien aus dem Gebiete du Naturwissenschaften*, ii. 316: St. Petersburg, 1876.

fact that a true hand ought to possess the power of rotation in a degree which exists in the fore, but not in the hind, extremities of apes. On this account I have already adopted, as more suitable and equally distinctive, the term of *prehensile foot* for this member.* I agree with Haeckel in rejecting the common designation of apes as four-handed or quadrumanous.

The bands or ligaments which connect the different parts of the anthropoid skeleton together, and convert the detached elements into a movable machinery, do not on the whole differ much from the same structure in man. A detailed account of these ligaments would, for several reasons, be out of place in this work, and I shall only mention a few special and more interesting distinctions. Such, for example, is the uncommon strength of the *ligamentum nuchæ* in the gorilla, which is quite in harmony with the great development of the spinous processes of the upper cervical vertebræ, and with the flattening of the squamous occipital portion. Since the sacral vertebræ are deeply inserted between the high ilia, the ilio-lumbar ligaments (*ligamenta iliolumbalia*) and the sacro-iliac ligaments (*ligamenta iliosacralia*) are of considerable size. In agreement with the projection in a downward direction of the high, narrow ischial bones, the sacro-sciatic ligaments which extend between these and the sacrum are very long in the chimpanzee. Although in this case the ischial spine is only represented by a roughness of the bone, yet there is on either side between this

* Hartmann in *Archiv. für Anatomie*, etc., p. 653: 1876.

and the sacrum a powerful lesser sacro-sciatic ligament (*ligamentum spinoso-sacrum*).

The well-known anatomist, J. F. Meckel, has asserted that the depression in the head of the femur (*fovea capitis*), which serves for the insertion of the round ligament (*ligamentum teres*), is absent in the chimpanzee and orang, and he adds that it is also absent in the gibbon. In a skeleton of a young chimpanzee which had not shed its milk-teeth, and of which the ligaments were also preserved, Welcker found a fully developed round ligament inserted almost in the centre of the head of the femur. This agrees in every particular with the same formation in man. On the other hand, no trace of a round ligament was to be found in the hip-joint of a young orang-utan. The cartilaginous envelope of the head of the femur was smooth throughout, without any indication of a place for inserting the ligament. Welcker again found no such depression in the femur of an aged male orang-utan, nor was there any trace of it in another aged male orang, designated as *Simia Morio*. Welcker believes that he has established the fact that the round ligament is wanting in the orang-utan, but that it is present in the gorilla, chimpanzee, and gibbon. The same naturalist remarks that, although we may certainly assume that the round ligament is absent wherever there is no depression in the head of the femur, yet the existence of such a depression in the acetabulum (*fovea acetabuli*) is not enough to prove that a round ligament was inserted in it. The innominate bones of an adult orang-utan were examined by Welcker,

and displayed a small, but well-defined depression, as if destined for a receptacle for this ligament,* running from the cotyloid notch down to the bottom of the acetabulum, between the two horns of the semilunar-shaped articular cartilage.

In a subsequent paper, Welcker states that the absence of the round ligament in the orang-utan, and its presence in the chimpanzee, had been previously established by Camper and Owen.† In three specimens of orangs which he had obtained immediately after death, Owen found that the round ligament was imperfectly developed on both sides. The chimpanzee differs from the orang in possessing a depression on the head of the femur. In the gorilla, as Owen observes, this depression has almost the same depth and relative position as in man. At Welcker's request, Professor Dippel ascertained the presence of the depression in the femur of a gorilla skeleton which is preserved in the natural history collection at Darmstadt. St. George Mivart saw the skeleton of an orang in which the femur was marked with a slight but plainly indicated depression, just where the round ligament is usually attached. Welcker thinks it probable that in some specimens of the gorilla the round ligament is only slightly developed, and that in others it is altogether wanting. On several

* Welcker in His and Braune's *Archiv. Jahrg.*, i. p. 71.

† Camper, *Œuvres*, i. 152; *Naturgeschichte des Orang-utan*, etc.; Owen, *Transactions of the Zoological Society of London*, i. 365–368; Ibid., v. 15; Welcker in His and Braune's *Archiv. Jahrg.*, ii. p. 106.

femurs of gorillas, this naturalist observed only doubtful traces of the depression in question. Duvernoy found the round ligament fully developed in the gorilla and chimpanzee. Vrolik failed to find it in the orang-utan, but ascertained its presence in the chimpanzee. Gratiolet and Alix saw that it was fully developed in *Troglodytes Aubryi.*

In addition to these somewhat conflicting assertions, I have myself observed, in the gorilla innominate and femur bones examined by me, more or less distinct indications of the depression which receives the round ligament. The ligament itself has been preserved with the body of a gorilla. The same remark applies to the skeletons and bodies of chimpanzees. In the case of the skeleton of an orang, slight indications of a depression were observed on the head of the left femur, and these indications were absent in the femurs of other specimens. In a large orang-utan which died in the Berlin Aquarium, only short, filamentous tufts of streaky fibres were apparent in the right acetabulum, and these were intermingled singly or in groups with the cartilaginous cells, somewhat resembling the cartilaginous corpuscles of the synovial membrane. From these facts we may conclude that the round ligament is generally but not invariably present in the gorilla and chimpanzee, and that it is altogether absent in the orang-utan. In the gibbon it is present in the majority of cases. I have myself observed it in *Hylobates agilis, leuciscus,* and *syndactylus.* Owen asserts that the unsteady gait of the orang is partly due to the absence of this ligament, but the truth

of this surmise is rendered doubtful by the fact that the ligament is not unfrequently absent in other anthropoids. Moreover, the gait of all these arboreal and climbing animals is extremely ungainly.

The muscular system of anthropoid apes is very interesting. I must necessarily refrain from giving a detailed account of it, and will only mention some points in connection with this organic system, and their relation to corresponding points in the muscular system of man. I rely partly on the researches of others, and partly on my own. The amount of material which has been collected up to this time is, unfortunately, too scanty to enable us to draw satisfactory conclusions in all cases. We are often unable to decide whether the conditions presented to us in the case of anthropoids are normal or exceptional. Nor are the statistics of muscular variations in the human subject by any means firmly established. My own labours in this direction are not yet concluded. The assertions on the subject which have been published to the world and accepted as authoritative have already been shown to be to some extent untrustworthy. Even the little which I am now able to produce may not altogether stand the test of subsequent research. Brühl justly remarks that in no department of anatomy more than in that which treats of the muscles, is it more essential that we should not decide whether a form is normal or exceptional until it has been repeatedly examined.*

The cranial muscles of anthropoids are formed

* *Wiener medicinische Wochenschrift*, p. 4: 1871.

like those of men, except in a few unimportant particulars (comp. Figs. 48 and 50). I have not observed in anthropoids the muscular fibres which in man branch out from the orbicular muscle of the eye, and overlap the cheeks and temples, and which are considerably developed in the head of a Monjalo negro which was dissected by me (Fig. 49, 3, 3′ In

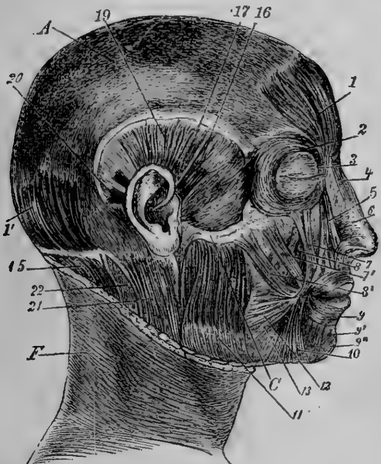

Fig. 48.—Muscles of the head and face of a European. 1, 1′, Occipito-frontalis. 2, 3, Orbicularis palpebrarum. 4, Pyramidalis nasi. 5, Levator labii superioris alæque nasi. 6, Compressor naris. 7, Levator labii superioris. 7′, Zygomaticus minor. 8, Levator anguli oris. 8′, Zygomaticus major. 9, Orbicularis oris. 9′, Levator menti. 9″, Depressor labii inferioris. 10, Depressor anguli oris. 11, Masseter. 12, 13, Risorius and the buccinator by which it is covered. 15, Trapezius. 16, Attrahens. 17, 19, Attollens. 20, Retrahens aurem. 21, Sterno-mastoid. 22, Splenius. A. Tendinous aponeurosis. C. Malar bone (the parotis is removed). F. Skin of neck.

apes that portion of the orbicular muscle which covers the supra-orbital ridge is very marked. There is generally a considerable layer of muscle on the nose and upper lip. I have dissected it in detail in anthropoid and other apes, including those

of America; *i.e.* the zygomatic muscles, the levator labii superioris, and the levator labii superioris alæque nasi. This has also been done by Duvernoy, Alix, and Gratiolet, in the case of anthropoids dissected by them, as well as by Macalister and Bischoff.

Bischoff was only able to identify a wide zygomatic muscle in the orang with the small zygomatic

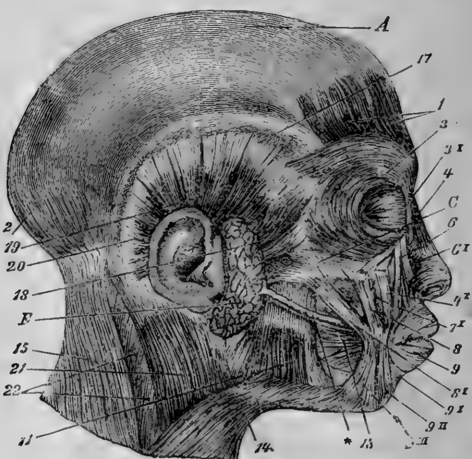

Fig. 49.—Head-muscles of a Monjalese negro. 1, 2, Occipito-frontalis. 3, 3′, Orbicularis palpebrarum. 4, Pyramidalis nasi. 4′, Levator labii superioris. 6, Levator labii superioris alæque nasi. 6′, Compressor naris. 7′, Levator anguli oris. 8, 8′, Zygomatici major et minor. 9, Orbicularis oris. 9′, Levator menti. 9″, Depressor labii inferioris. 9‴, Depressor anguli oris. 11, Masseter. 13, Buccinator. 14, Platysma. 15, Trapezius. 17, 18, Attollens and attrahens aurem. 19, Embedded temporal muscle. 20, Retrahens aurem. 21, Sterno-mastoid. 22, Deeply set muscles of neck. A, Tendinous aponeurosis. C, Zygoma. E, Parotis. *, Stensonian duct.

in man. In the orang, the gibbon, and the baboon, as well as in *Innus sinicus* and *Ateles,* I myself was quite able to trace a division into a large and small zygomatic. In the gorilla dissected by me the

levator labii superioris alæque nasi was very wide (Figs. 50, 6). In the case of a gorilla, Ehlers dissected the small zygomatic muscle, together with the levator labii superioris alæque nasi, in the manner introduced by Henle as a single square muscle of the upper lip (*Musculus quadratus labii superioris*). In the gorilla I observed a levator alæque nasi, together with the already mentioned

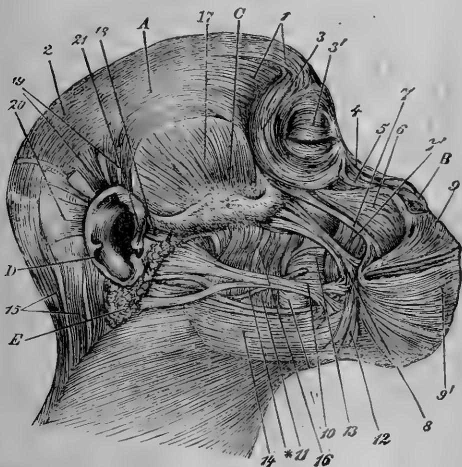

Fig. 50.—Head-muscles of gorilla presented in Fig. 3. 1, 2, Occipito-frontalis. 3, 3', Orbicularis palpebrarum. 4, Pyramidalis nasi. 5, Levator alæ nasi. 6, Levator labii superioris alæque nasi. 7, Zygomaticus minor. 7', Levator anguli oris. 8, Zygomaticus major. 9, 9', Orbicularis oris. 10, Risorius. 11, 16, Masseter. 1', Buccinator. 12, Depressor anguli oris. 13, Buccinator. 14, Platysma. 15, Trapezius. 17, Temporal. 18, 19, 20, Attrahens, attollens, and retrahens aurem. 21, Lesser muscle of helix. A, Tendinous aponeurosis. B, Cartilage of nostril. C, Zygoma. D, External ear. *, Stensonian duct.

levator labii superioris; but I failed to find any separate levator labii superioris. The very wide cartilage of the nose is occupied by a considerable amount of muscular tissue. All these muscles are

present in the orang, but they are of small size and separated into detached bundles. The pyramidalis nasi may be traced in every instance, especially in the gorilla (Figs. 50, 4) and in the orang. It is not so strongly developed in the chimpanzee and gibbon, but is not absent in these apes, nor in those which are not anthropoid, such as the baboon, and ateles, or climbing ape.

I myself follow the original division of the muscles into those which belong to the nostril and upper lip, in accordance with the principles of Duchenne, Darwin, Gamba,* and others, and I do so the more readily, since it is impossible not to perceive the manifold and lively mimetic action which takes place in this particular region of an ape's head. The distinct action of the levator labii superioris alæque nasi, the dilation of the nostrils, the function of a strongly developed levator anguli oris, are especially characteristic of the gorilla; but they are also perceptible in the chimpanzee and gibbon. The orang's face is the least mobile. I observed that in the gorilla the risorius was very long, branching slightly in the fore-part of the corner of the mouth, and behind into three distinct wide bundles. The lowest bundle covered the platysma myoides, but could not be regarded as part of the latter. In one chimpanzee I found that the risorius was slightly developed, and in other animals of that species I failed to trace it at all. Alix and Gratiolet represent the

* Duchenne's *Mécanisme de la physiognomie humaine.* Darwin's *Expression of the Emotions.* Gamba's *Lezioni di anatomo-fisiologia applicata alle arti belle.*

Aubry chimpanzee (Plate ix. Fig. 1, 15) with the risorius strongly developed. I have not observed this formation either in the orang or the gibbon, but it was apparent in one of the ateles (*Ateles leucophthalmos*). In this case the muscle covered the platysma myoides and Stenson's duct, *i.e.* the duct leading out of the parotid gland (Fig. 50, *).

For some time I was disposed to regard the risorius of this ape as only a radiation of the platysma myoides, but my opinion upon this point is again shaken.

In the gorilla a faint depressor anguli oris and an equally faint depressor labii inferioris may be observed, the latter partly covered by the large and predominant orbicularis oris (Fig. 50). In the chimpanzee the two depressors are plainly apparent, and in the gibbon the one first named was at any rate developed. The platysma myoides, the depressors just mentioned, and the crescent-shaped orbiculares are in this animal in close connection with each other. Froriep's suggestion becomes ever more probable, that these muscles of the lower lip owe their origin to the intersection of the opposite portions of the skin-muscles of the neck which overlap the face. The buccinator muscle in anthropoids resembles on the whole that of man, and in both cases is pierced by Stenson's duct (Fig. 50). The form of the masseter muscle is common to both (see Fig. 50, 11, 16). In the external ear of anthropoids there is an attrahens, attollens, retrahens (Fig. 50). Compared with that of a white man, and still more with that of a negro (see Figs. 48, 19, and 49, 17), the attollens is

only slightly developed. The muscles attached to the cartilages of the ear are extremely scanty or partially wanting, which is also sometimes the case with man. The muscles of the helix are most strongly marked in the gorilla (see, for example, Fig. 50, 21). Tiedemann, Bischoff's brother-in-law, carefully observed two living chimpanzees in Philadelphia for six months without detecting any movement of the ears. My own observation confirms his assertion and the remarks of Darwin, which I have already quoted, to the effect that anthropoids are incapable of moving their ears. I know of no individual exceptions. This is the more remarkable since some men have retained the power of voluntarily moving their ears, and the same power is also found in some species of apes, such as the sea-cats, baboons, macacas, and magots.

It will not here be out of place to say something of the characteristics, previously mentioned, of the physiognomical expression of anthropoid apes. Thus, for example, when the gorilla is agitated, he can move the skin of his head and bristle the hair which covers this region. The chimpanzee can also move the skin of the head, but with no very apparent bristling of the hair. The large male orang, which was in the Berlin Aquarium in 1876, bristled his hair and the skin of his head when he was much enraged. It is known that in some instances man also possesses this power.

I have already spoken of the expression of the eyes of these animals. I will only add that when anthropoids of every species are in great pain or

seriously ill, the expression of their eyes is often most affecting.

The forehead of these animals is frequently marked by transverse furrows, and especially, as Darwin justly observes, when they raise their eyebrows. The same great observer considers that the countenances of anthropoids are, in comparison with those of men, generally inexpressive, and indeed, chiefly in consequence of the fact that they do not wrinkle the forehead when they are excited. The wrinkling of the forehead, which is one of the most significant forms of expression in man, is due to the action of the corrugatores supercilii, by which the eyebrows are drawn down and closer to each other, so as to form vertical folds on the forehead. It has been asserted that the orang and chimpanzee possess these muscles, but they seem to be rarely exercised—at any rate, to any remarkable extent.* When Darwin brought a chimpanzee out of his dark chamber into bright sunshine, he only once observed a slight wrinkling of the forehead. When the same observer tickled the nose of a chimpanzee with a straw, its face was slightly wrinkled, and faint vertical furrows appeared between the eyebrows.† Darwin never observed any wrinkling of the forehead in an orang. I myself have observed a contraction of that region of the

* Macalister, in the *Annals and Magazine of Natural History*, vii. 342 (1871) asserts that he was unable to distinguish the corrugator from the orbicular muscle, and I have been equally unsuccessful.

† Darwin's *Expression of the Emotions.*

brows which is covered with bristly hairs, and a wrinkling of the skin which covers the bridge of the nose in the gorilla and the chimpanzee, and have illustrated this expression by a drawing.

Darwin goes on to say that when a young chimpanzee is tickled, to which, as in the case of children, their armpits are peculiarly sensitive, he generally utters a chuckling or laughing sound, although sometimes the laugh is silent. The corners of the mouth are then drawn back, and this sometimes causes the eyelids to be slightly wrinkled. This wrinkling, which is so characteristic of the human laugh, is still more apparent in some of the other apes. In the chimpanzee the teeth of the upper jaw are not exposed when he utters this laughing sound, and in this respect he differs from man. Darwin further observes that when the tickled young orang ceases to laugh, an expression passes over his face, which, according to Wallace, may be called a smile. Darwin has observed something similar in the chimpanzee.*

My own observation confirms what has been said of the chuckling of a tickled chimpanzee. When Dr. Hermes, the director of the Berlin Aquarium, played with the chimpanzee which was kept in that establishment, a contortion of the corner of the mouth, resembling a somewhat sardonic smile, at once appeared. No specimen displayed this smile with so much effect as the lively Augustus, who delighted visitors by his inexhaustible humour in 1879. The gorilla, of which an illustration is given

* Darwin, *Expression of the Emotions.*

in Fig. 3, also drew down the corner of his mouth when he was pleased, by means of the muscular system which we have just described.

When the gorilla is provoked, he displays both rows of teeth, and opens his mouth to utter sounds of fury, while making ready to fight. It is well known that anthropoids are able to pout and project their lips; and Darwin says that they do this, not only when they are slightly teased, and are sullen or disappointed, but also when anything occurs to make them uneasy.

I have often observed in chimpanzees a slight wrinkling of the region of the nasal cartilage, and even a vibration in a lateral and upward direction. In any case, the muscles which we have described as acting on the nose and upper lip are exercised.

The platysma myoides, which extends in man from the lower row of teeth to just below the clavicle, occupies about the same area in the gibbon and in other apes (Fig. 50). In the chimpanzee, however, this muscle extends as high as the zygomatic arch, or even higher. In the gorilla also I observed that this part extends comparatively high on the face. In chimpanzees, orangs, and gibbons the upper fibres of this muscle seem to form the risorius. In one case the platysma myoides sent forth a fasciculus, about 18 mm. in width, to the beginning of the lower temporal ridges. In the gorilla I saw that the uppermost fibres of the platysma myoides were partly covered by the risorius (Fig. 50, 10).

From the corresponding muscle in the orang the

lower fibres tend far backward, and are in connection with the deltoid muscle covering a segment of the capsular ligament. This muscle wrinkles the skin of the neck, and helps to draw down the lower jaw. In cases in which it extends far in an upward direction, as in those we have cited, it affects the lateral extension of the middle and lower skin on the faces of these animals, as well as the grinning contortion of the corner of the mouth. It may also have to do with the grumbling sound issuing from the throat-pouch, which is uttered by the animal when agitated, as he rapidly opens and closes his mouth.

The strong sterno-cleido-mastoid muscle found in these animals, and especially in the orang and gibbon, can be divided without difficulty into a sternal and clavicular portion. The two portions diverge from each other in a downward direction. As Bischoff justly states, a muscle not hitherto observed in man may be traced in all four species of anthropoids, a muscle which extends from the external part of the clavicle to the transverse process of the first cervical vertebra. Bischoff has called it the musculus omocervicalis. It is found in other apes, although the site of its origin varies, sometimes occurring on the spine of the scapula. Our Munich anatomist differs from Huxley in regarding this muscle as "a brilliant proof of the relation of all apes with each other." I give this assertion without further comment.

The muscles which extend between the head, sternum, and clavicle, together with the muscles of the acromion process of the scapula, make an ex-

ternal covering to the throat-pouch, which I shall describe presently. The pectoralis major of the gorilla, as well as that of man, divides into two portions, one attached to the clavicle, the other to the cartilages of the true ribs. The former is divided from the deltoid by a wide interval, filled with connective tissue and fat. But both portions of the pectoralis major are divided by a tolerably wide space, into which, in Bischoff's opinion, the throat-pouch is inserted. This, however, I do not believe, since that organ would be compressed and strangulated between the two portions of muscle whenever they were exercised. It may, however, be supposed that room for an enlargement of the throat-pouch when the animal is bellowing is afforded by the existence of these spaces. Bischoff is right in the assertion that the clavicular portion of the pectoralis major is wanting in the orang-utan. The upper part of this muscle springs directly from the sternum. The lower sternal ribs give origin to the pectoralis minor. The chimpanzee and gibbon display clearly in this muscle the separation we have mentioned into a clavicular and a sternal portion.

The structure of the pectoralis minor in these apes is full of interest. In the gorilla it divides into an upper portion of firmer tissue, less easily separable into digitations, which arises from the third to the fifth ribs, and a lower portion, separable into three digitations, of which the upper segment laps considerably over the lower segment of the upper portion. In the chimpanzee an upper portion of less firm

texture extends from the second to the fourth, and a lower with three digitations from the fourth to the seventh ribs. This second lower portion is sometimes absent. I have seen the upper portion attached to the coracoid process of the scapula, and the lower portion to the ridge of the greater tuberosity of the humerus. In the orang an upper portion, separable into three digitations, extends from the second to the fifth ribs, and is attached to the coracoid process. A lower portion, also separable into three digitations, extends from the fifth to the seventh ribs, and is also attached either to the greater tuberosity of the humerus or to its edge; this latter portion projects below over the pectoralis major. In the gibbon (*Hylobates albimanus*), the upper portion starts from the second, the lower from the third to the fifth ribs. It may here be remarked that the pectoralis minor is in man also sometimes separable into digitations, which may be connected both with the coracoid process and with the capsular ligament of the shoulder-joint. In anthropoids the tendon of insertion of this muscle is remarkably slender.

According to Duvernoy, in the gorilla a fibrous, hood-like fascia covers the whole region of the occiput and neck. In adult males this fascia is 20 mm. in thickness. In a female dissected by me the rudiments of a similar hood-like cervical fascia were present. Duvernoy is justified in supposing that this is not yet developed in the young gorilla, and that a layer of connective tissue and fat is substituted for it. In a young gorilla I saw the trapezius divided into distinct bundles of flesh by layers of

fat (Fig. 50, 15). The fascia corresponds to the great development of the trapezius, and the same characteristic development exists in other anthropoids. The adult male gorilla displays a powerful *ligamentum nuchæ* in connection with the long spinous processes of the cervical vertebræ, as well as powerful inter-spinales muscles, spinales colli, and semi-spinales colli and dorsi. The great development of the spinous processes of the dorsal vertebræ of gorillas (Fig. 17), and also chimpanzees and orangs, involve the development of powerful semi-spinales, as well as of strong, fourfold spinales and inter-spinales muscles. The whole of the fleshy formation of the neck of an adult male gorilla which is covered by the trapezius is very voluminous, and especially the splenius capitis and colli, the long cervical muscle (*Musculus longissimus cervicis*), and the long head-muscle (*Musculus longissimus capitis*), which have also been regarded by me as parts of the long spinal extensor, and finally the oblique and vertical muscles at the back of the head. With Chappuy, I am disposed to regard the latter as modifications of the spinales and inter-spinales.

The levator anguli scapulæ is divided in anthropoids as in man. The subclavius is slender, except in the gorilla, and in the latter animal it sends a tendon obliquely to the coracoid process.

In all anthropoids the deltoid is strongly developed. In the gorilla it projects forwards and outwards in order to attach itself to the humerus, almost in its centre. Here it is separated from the brachialis anticus in a manner with which we are

only imperfectly acquainted. It extends nearly as far in the gibbon and orang, while in the chimpanzee its attachment is higher up. Bischoff observes, and it was previously suggested by Vrolik, that in the chimpanzee the coraco-brachialis muscle possesses at its origin a moderately large second portion, which tends downwards over the lesser tuberosity of the humerus, and adheres to its edge. But I have seen both portions of the muscle in question attached to the coracoid process of the scapula in apes of this species. In the gorilla, orang, and gibbon the position of this muscle corresponds to that in man.

Chapman and Bischoff speak of a muscle common to all apes which starts from the tendinous attachment of the *latissimus dorsi* on the edge of the lesser tuberosity of the humerus, and tends downwards on the inner side of the humerus, and to this muscle they give the name *latissimo-condyloideus*. Bischoff goes on to say that this muscle goes in some cases into the fascia which covers the biceps; and in others, as in the baboon, it is attached to the inner inter-muscular septum and to the internal condyle of the humerus. In the gibbon it only extends as far as the centre of the humerus, but in the orang it reaches to the condyle, where it is pierced by the ulnar nerve. Bischoff adds that this formation is wanting in man.

This structure is indeed remarkable in anthropoids. The muscle starts in a lateral direction from the insertion point of the *latissimus dorsi*. In the gorilla alone I observed that it started from the coracoid process of the scapula, together with the

two portions of the pectoralis minor; it was connected for a space with the coraco-brachialis, and finally it was attached, in the upper part of the lower third of the humerus, to the inter-muscular septum which is found between the brachialis anticus and the triceps. In the chimpanzee, on the other hand, it has its origin in the *latissimus dorsi,* and divides into an anterior and posterior portion; the former is attached to the inner condyle of the humerus, while the latter is connected either with the middle or inner head of the triceps. In the orang the same division of this muscle may occur. In one of these animals I observed an anterior portion, very thin and semi-membranous, attached by an extremely slight tendon to the coracoid process of the shoulder-blade, while the hind portion issued from the *latissimus dorsi.* They were both in connection with the triceps and brachialis anticus. In other instances the muscle consisted only of the posterior portion, issuing from the *latissimus dorsi.* In the white-handed gibbon, the muscle issued from the region in which the tendons of the *latissimus dorsi* and of the teres major are united, and was inserted into the fascia which is found between the bicipital and the brachialis anterior. This attachment may also occur in the centre of the shaft of the humerus. Chapman and Chudzinsky have observed anomalous instances of this formation in coloured races.*

It is well known that in man the biceps is inserted into the tuberosity of the radius by means of

* *Proceedings of the Academy of Natural Sciences of Philadelphia,* 1879. *Revue d'Anthropologie,* 1873, 1874.

a flattened round tendon. This tendon, however, opposite the bend of the elbow, gives off a broad expansion, which passes into the fascia of the forearm, and is termed *Aponeurosis bicipitis.* In the gorilla this aponeurosis is carried on as strong fibrous bundles of the fascia of the forearm into the palmar fascia. In the gibbon the short head of the muscle does not always start from the lesser tuberosity of the humerus, nor from the tendon of the pectoralis major (Huxley), but sometimes from the edge of the lesser tuberosity, which is here connected with the *latissimus dorsi,* as well as with the sub-scapularis, the brachialis anticus, which is more to the side, and with the triceps. In the gibbon, as Bischoff justly observes, the supinator longus only reaches as far as the centre of the radius, instead of extending to the styloid process of that bone, as it does in other anthropoids, and in man.

The palmaris longus is wanting in the gorilla, but not in other anthropoids. The long flexor muscles of the fingers and the lumbricales resemble those of man (Figs. 51, 52). The flexor longus pollicis is absent in the gorilla. Duvernoy considers that it is replaced by a tendon of the long flexor of the fore-finger, but I have been unable to verify the existence of this tendon. The same muscle is also absent in the chimpanzee and the orang, but it may be traced in *Hylobates albimanus.* Chapman states that in the gorilla the pronator radii teres only sends forth one head,* but I have

* *Proceedings of the Academy of Natural Sciences of Philadelphia,* 1879.

found it to be bicipital in animals of this species. The lower or hinder head issues, as in man, from the coronoid process of the ulna. Both in the gorilla and in the chimpanzee it extends far in a downwards direction on the radius (Fig. 52). The flexor carpi radialis starts in the chimpanzee with one head from the inner condyle of the humerus, and with the other from the radius. Bischoff describes the structure of the long abductor of the thumb in the orang, the baboon, the *pithecia*, and the *hapale* as resembling that of man. But in the gorilla, the chimpanzee, and the macaca the tendon divides into two parts. Nor does one tendon belong, as in man, to a short extensor of the thumb, but the latter is wholly absent, and the division of the tendon only implies a continued division of the attachment to the trapezium, as well as to the metacarpal bones of the thumb. This division of the tendon also occurs in the gorilla, which likewise possesses a short extensor of the thumb. In this point, again, apes display a greater likeness to one another than to man.

According to my own researches, the long abductor of the thumb in anthropoids forms a muscle not more considerable than one in proximity with it, of which the origin and more central direction recall the short extensor of the human thumb. In all four species I found that the abductor had two tendons, and was attached to the trapezium. The muscle in its vicinity is inserted above the base of the first metacarpal bone. I have not been able to discover an extra extensor of the thumb in the gorilla. The question now arises what we should

think of the second muscle, which is found in these animals in the vicinity of the abductor. In my

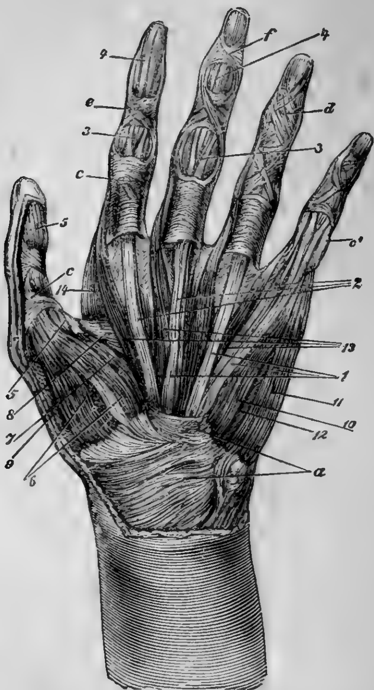

Fig. 51.—Palmar muscles of man. *a*, Ligaments of wrist, especially the anterior ligament. *c*, *c′*, Sheathing ligaments. *d*, *e*, *f*, Oblique fibres of the ligaments of the sheath of the flexor tendons. 1, 2, Tendons flexor sublimis, and of the flexor profundus muscles of the fingers. 3, The reciprocal perforation of these tendons. 4, Continuation of the tendons of the flexor profundus of the fingers. 5, Tendon of the flexor longus pollicis. 6, Abductor pollicis. 7, 8, 9, Flexor brevis, adductor, and opponens pollicis. 10, 11, 12, Flexor brevis, abductor, and opponens minimi digiti. 13, Lumbricales. 14, First dorsal inter-osseous muscle.

opinion, it may be confidently accepted as a short extensor of the thumb, since it always effects an extension of the metacarpal bone of that member,

and in this act of extension it is supported by the long extensor which acts upon the phalanges. It

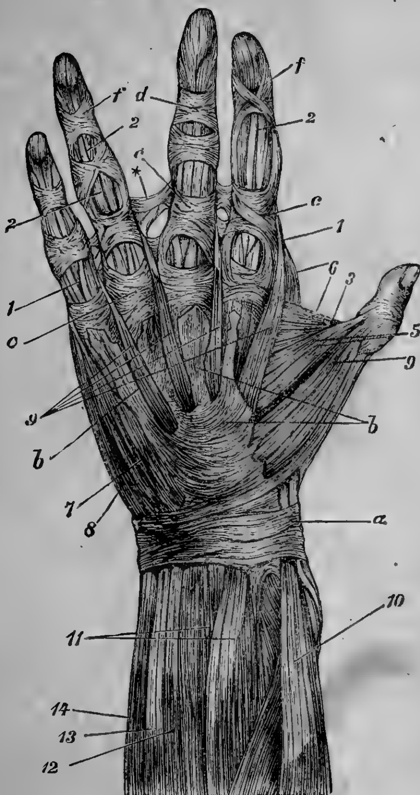

Fig. 52.—Palmar muscles of gorilla. *a*, Anterior ligament. *b*, Remains of the skin of palm, here covered with a very sinewy skin. *c*, *f*, Oblique fibres of the ligaments of the sheath of the flexor tendons of fingers. 1, 2, Flexor tendons. 3, Spaces between the heads of the flexor brevis pollicis, whence in man the tendon of the flexor longus pollicis issues (comp. Fig. 51, 5). 4, 3, 3′, 5, Abductor, flexor brevis, abductor pollicis. 6, 7, 8, Opponens, flexor brevis, abductor, minimi digiti. 9, Dumbricales. 10, Supinator longus. 12, Flexor sublimis digitorum. 13, Flexor minimi digiti. 14, Flexor carpi ulnaris.

must be remembered that the comparatively short thumbs of anthropoids have not to be employed in so many different ways as the human thumb, and that we cannot therefore be surprised that the development of the short extensor is less complete. A special extensor muscle of the index finger is either altogether absent in the gorilla or very slightly developed, while it is very apparent in *Hylobates albimanus* (6, Fig. 53). In the chimpanzee

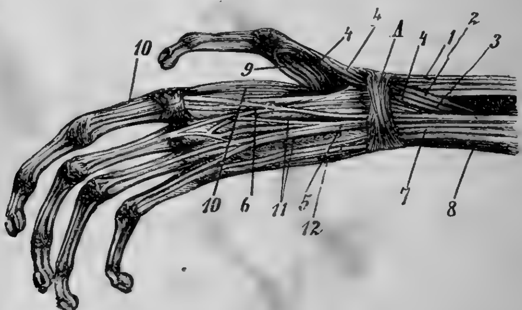

Fig. 53.—Muscular system of the back of a gibbon's hand. 1, The extensor carpi radialis longior and brevior. 2, Abductor longus pollicis. 3, Extensor primi internodii pollicis. 4, Extensor secundi internodii pollicis. 5, Extensor communis digitorum. 6, Extensor indicis. 7, Extensor minimi digiti. 8, Extensor carpi ulnaris. 9, First dorsal inter-osseous muscle. 10, Continuation of the same to index finger. 11, 12, The other inter-osseous muscles of this region. A, The posterior annular ligament.

this muscle sends a tendon to the middle finger. In the orang there is one extensor common to the four fingers. In the gibbon's hand, this, as well as the other extensor and flexor muscles, is remarkable for its excessive slenderness. The manifold connections of the extensor tendons with each other are an interesting peculiarity (Fig. 53).

In the chimpanzee I observed a superficial flexor,

common to the fingers, and enlarged in the region of the third and little fingers. A superficial flexor, belonging to the index finger, started from the inner condyle of the humerus, and from the back of the inter-muscular septum. The deep finger-flexor was attached to the four fingers. In the orang the first of these flexors forms a two-tendoned belly for the index finger, as well as one for the other three fingers. The deep flexor only displayed two bellies. In the gibbon, on the other hand, the superficial flexor displays four bellies.

In the carpus of the chimpanzee there is, so far at least as my experience goes, a so-called sesamoid bone. It is in this instance in connection with the scaphoid and trapezium bones, just where the fibres of the anterior and posterior ligaments of the wrist pass into each other. In the chimpanzee the tendon of the long abductor muscle of the thumb sends some fibres into this sesamoid bone, while the other fibres of the tendon of this muscle, which divides into several strips, are inserted in the trapezium bone, and a few also in the base of the first metacarpal bone.

The short flexor muscle of the thumb, of which Bischoff has denied the existence, is certainly present in these animals. In the chimpanzee the lower fibres of the short abductor muscle of the thumb have their origin in the sesamoid bone. The middle fibres, of the same muscle issue from the strips of ligament attached to the sesamoid bone. On the other hand, the upper part of the muscle has its origin in the anterior annular liga-

ment. In the orang, the lower fibres of the short abductor of the thumb likewise have their origin in the sesamoid bone, while the central fibres again start from the anterior annular ligament. The upper fibres are strong, and are inserted into the base of the first metacarpal bone. In a dissection of the orang the flexor longus pollicis sent a thin, tendinous expansion on to the bone. This sesamoid bone is also found in the gorilla, although Duvernoy and Rosenberg do not appear to be aware of its existence.*

In the palm of the gorilla's hand there is a short abductor, a short bicipital flexor, an opponens, and an abductor of the thumb. The longer belly of the short flexor extending in a more radial direction, and in connection with the opponens, is only slightly developed. In the muscular system of a gorilla's little finger we may observe an abductor, a short flexor, and an opponens. The palm of the chimpanzee displays a short abductor, an opponens, a short bicipital flexor, and an adductor of the thumb; also an abductor, a short flexor, and an opponens of the little finger. In the orang I observed a short abductor, a short flexor with two bellies, an opponens, and an adductor of the thumb. In addition to the short flexor of the thumb, Langer and Bischoff describe another short, independent muscle, representing the long flexor, and attached to the second phalanx, but I have not myself ascertained the existence of this muscle. The same

* Hartmann in *Archiv. für Anatomie*, by Reichart and Du Bois-Reymond, p. 743 (1875); p. 636 (1876).

anatomists mention an adductor between the third metacarpal bone and the first joint of the thumb, and another between the second metacarpal bone and the second joint of the thumb, passing on into the extensor tendon. I am myself convinced of the existence of a twofold adductor, but not of the fact that the tendon of one of the muscles (termed by Langer the second opponens) passes on into the extensor tendon. In the little finger of the orang there is an abductor, a short flexor, and an opponens. In the gibbon there is a short abductor, a faintly indicated opponens, a short bicipital flexor, and an adductor of the thumb. In *Hylobates albimanus* this adductor divides into four or five portions, which are attached to the whole of the first metacarpal bone. In the little finger there is an abductor, a short flexor, and an opponens. In the same animal the first inter-osseous muscle is attached by one portion to the second metacarpal bone, by the other to the base of the second phalanx of the index finger (Fig. 53, 9, 10).

Bischoff has described the muscles which Halford terms *Contrahentes digitorum* (contractors of the digits), which lie deep in the palm of the hands and feet of the chimpanzee and gibbon, the mandril, baboon, and other apes.* They rest upon the inter-osseous muscles, and are covered by the tendons

* Halford, *Not like man, bimanous and biped, nor yet quadrumanous, but cheiropodus:* Melbourne, 1863. *Lines of demarcation between Man, the Gorilla, and the Macaca:* Melbourne, 1863. I only know these two treatises from Bischoff's quotation. *Anatomie, etc., des Hylobates leuciscus*, pp. 23, 24.

of the long flexors of the digits, as well as by the lumbricales muscles. I have been unable to trace these *Musculi contrahentes* in the gorilla. In a female chimpanzee I observed a *Musculus contrahens* for the fourth, and another for the fifth finger, and the same for the fourth and fifth toes. In the orang I observed a *Musculus contrahens* for the fourth, and one for the fifth fingers, and two faintly indicated *Contrahentes* for the fourth and fifth toes. Similar muscles of the second, fourth, and fifth fingers, and of the fourth and fifth toes, may be observed in the white-handed gibbon.

In correspondence with the height of the pelvic bones, the gluteus maximus of these animals only displays a moderate width in comparison with its length. The tendon which attaches it to the femur extends low down, almost as far as the knee-joint. The gluteus medius and minimus are also long, in correspondence with this structure of the pelvis, although they are attached to the large trochanter, and to the posterior inter-trochanteric line. The climbing muscle (*Musculus scansorius*), which extends between the hip-bone and the condyles of the femur, was discovered by Troill in the chimpanzee, and by Bischoff in the orang, and is described by them as strongly made; it appears to be absent in the gorilla and the gibbon. The pyriformis generally forms portions of the neighbouring muscles. The tensor vaginæ femoris, which is strong and wide in most anthropoids, is either greatly reduced or altogether absent in the orang. The sartorius is not, as in man, attached to the inner surface of the

tibia, just below the internal tuberosity, but it is inserted much lower down on this surface. In the gorilla it has a tricipital attachment, one to the deep fascia of the thigh, and two others to the internal border of the tibia. In the chimpanzee and the gibbon the muscle extends equally low down. In the orang it does not go so far, but the *gracilis* and *semi-tendinosus* are in the same relative position. The biceps of the femur is very apparent in the orang; its long head divides in two parts, of which the lower is inserted in the fibula, and is here united with the short head.

Bischoff at first denied the existence of the plantaris in the chimpanzee, and Brühl had previously done the same, but it is as normally present in that animal as in man, in whom also it is sometimes absent. I, however, as well as other observers, have failed to discover it in the gorilla, orang, and gibbon. The popliteus is developed in every instance. The tibio-fibular muscle (*Musculus peroneo-tibialis*), covered by the popliteus, of which the existence was ascertained by Gruber, has not been observed by me in any of the anthropoids, with the exception of the chimpanzee. But it was very apparent in a red sea-cat monkey (*Cercopithecus ruber*).

The gastrocnemius, which is easily separable into two heads, and the peroneal muscles have not the same relative width in anthropoids and man, since in the former case the calf of the lower limb is small, and it lacks the pleasing roundness which characterizes this part of the human structure. These muscles, especially in the orang and gibbon,

appear to take a lateral direction. The Tendo Achillis is present, but it has not the prominent development in height and width which we observe in man. The long extensor, flexor, and tibial muscles are in all cases fully developed. The peroneus tertius, as it is termed, although it should only be regarded as a part of the extensor longus digitorum, is absent in anthropoids.* I myself am not disposed, with Huxley, Bischoff, and others, to regard this muscle as an abductor. Brühl perceived in a chimpanzee a fourth rudimentary peroneal muscle (*Musculus peroneus intermedius*), extending between the peroneus and the little toe, a muscle sometimes found in man, and which I have myself only observed in one adult chimpanzee. In the gorilla and the chimpanzee the extensor longus digitorum passes through a remarkably strong transverse ligament, formed of fibrous cartilage, which covers the tarsus. It acts upon the four outer toes (Fig. 55). Brühl has described the characteristic contraction and extension of the tendons of the long and short extensors of the toes in the chimpanzee, but I have myself found some difficulty in producing this action. In Fig. 55 I have endeavoured to represent this condition in the most natural way. The extensor proprius pollicis is in all cases developed. The extensor brevis digitorum produces a large, oblique belly for the great toe (Fig. 55). In the gorilla there is for the great toe an abductor, a bicipital flexor, an adductor, and an opponens (comp. Fig. 54).

* Ruge also considers this muscle to be part of the extensor longus digitorum.

From the extensor brevis digitorum the belly for the great toe rises with a certain independence. On the right foot of a chimpanzee I observed a fifth belly of this muscle, going to the little toe (Fig. 55).

Fig. 54.—Muscular system of the human foot. 1, Tibialis anticus and extensor proprius pollicis. 2, Extensor longus digitorum. 3, Tendon of peroneus tertius. 4, 5, Peroneus longus and peroneus brevis. 4′, 5′, Tendons of the same. 6, 7, Tendons of the extensor longus and extensor brevis digitorum.

As my illustration is taken from this specimen, I have represented the foot with, or in spite of, this interesting anomaly, which, as we know, sometimes occurs in man.

The flexor brevis digitorum displays perforated

tendons, belonging to the second and third toes. The flexor longus digitorum displays perforated tendons for the fourth and fifth toes. The flexor longus pollicis divides into two tendons, one of which goes into the toe itself, while the other is connected

Fig. 55.—Muscles on the upper side of chimpanzee's foot. 1. Tibialis anticus muscle. 2, Extensor proprius pollicis. 3, Extensor communis digitorum. 4, 5, Peroneus brevis and peroneus longus. 6, Tendon Achilles. 7. Extensor brevis digitorum. 8, Slip of the same for great toe. 9, First dorsal interosseous muscle. 10, Adductor pollicis. 11, Abductor minimi digiti.

with the flexor longus digitorum, and displays perforated tendons for the third and fourth toes, while the perforated tendons of the second and fifth toes have their origin in the other flexor

In the gorilla the lumbricales muscles of the foot

are powerful. The first inter-osseous muscle is likewise well developed and bicipital. There is a short flexor and an abductor for the little toe. I have not yet been able to assure myself of the existence of an opponens for that toe. In the chimpanzee the muscular system of the great and little toe does not essentially differ from that which we have described in the gorilla. The flexor brevis digitorum forms the perforated tendons of the second and third toes. The flexor longus digitorum provides the fourth and fifth toes with perforated, and the second and fifth toes with perforating, tendons, while those which belong to the third and fourth toes have their origin in the flexor longus pollicis. As in the gorilla, the latter muscle produces a fibrous investment for the tendons of the flexor longus digitorum. In the orang there is an abductor of the great toe, a very slightly developed opponens, a short bicipital flexor, and an adductor. One of the long flexors of the toes appears to represent the flexor longus pollicis in man. It provides the second and fifth toes with perforating tendons, while those of the third and fourth toes have their origin in the other flexor longus digitorum. There is no long flexor tendon on the great toe. The perforated tendons in this case generally belong to the short flexor muscle. In addition to the perforated tendons of the fourth toe, there is the long flexor already described.

In a gibbon's great toe I observed an abductor, a short bicipital flexor, and a slightly developed opponens, to which a wide fan-shaped adductor is

attached. The first dorsal inter-osseous muscle is, as in the same animal's hand (Fig. 53), attached to the first phalanx of the second toe. The flexor longus digitorum provides the third and fourth toes with perforating tendons, and also gives off a tendon for the great toe. On the little toe there is a remarkably slender perforating tendon. While the first of the two long flexors represents the human flexor longus pollicis, the flexor longus digitorum is in this instance limited to the little toe. In the gibbon, as well as in the orang, the gorilla, and the chimpanzee, the two muscles are connected together by an aponeurosis. It may be here mentioned that in the human foot the flexor longus pollicis occasionally gives off a flexor for the second and even for the third toes. In the gibbon, as Bischoff justly observes, a muscle covers the flexor longus digitorum, which is still undivided, but already enlarged. From this muscle perforated tendons issue for the third and fourth toes. The second toe is provided with such a tendon from the flexor brevis digitorum. The muscle we have mentioned seems to represent the Quadratus plantæ, which is often developed in the other anthropoids, although only to a slight extent. With respect to the muscles of the small toe of the orang and gibbon, I need only say that in the latter species the opponens seems to be absent (Fig. 55).

It will be seen from the foregoing account that, in spite of several apparently important peculiarities, in spite of great and manifold variations which are established, even although our authorities

do not always agree together, the muscular system of anthropoids is on the whole very like that of man. It displays, especially in the lower limbs, peculiarities of structure which render them capable of walking in an upright position, and others again which they have in common with the lower animals, but on the whole the anthropoid characteristics of the muscular system of these animals are predominant.

The digestive system of anthropoids likewise affords interesting points of comparison. The cavity of the mouth is, as we have seen, bordered by large and flexible lips. The mucous membrane of the mouth and the gums are flesh-coloured; they assume a darker colour in older animals, and are then sometimes marked with spots of a bluish or brownish grey. Ehlers describes, as a peculiarity in the mucous membrane of the mouths of the gorilla and chimpanzee, that there are what he calls buccal folds, which pass on both sides from the fore surface of the upper and lower jaw into the mucous membrane of the cheeks, and are of the height of the canine teeth.* I have myself only observed these folds in the gorilla, of which an illustration is given in Fig. 3, and not in any other specimen. I have observed scarcely any indications of these folds in other anthropoids, and then only of such a doubtful nature that I am not disposed to regard the circumstance as of any special significance. A small band on the upper and lower lips, sometimes

* *Beiträge zur Kenntniss des Gorilla und Chimpanse*, p. 32, plate ii. fig. 3.

only slightly developed, but always perceptible, is present in all anthropoids.

The tongue is small, and not provided at its base with several great concave follicles as in man; these are at least only faintly represented, and not easy to observe. Around them there rise pock-like, tufted warts, very close together, which in an aged gorilla are apt to become hard and horny. These are also prominent between the follicles of the tonsils. The circumvallate papillæ of the tongue are less numerous than in man, and often, especially in the chimpanzee, they take the form of a cross, or of the letter T, or in the gorilla of a V.

The uvula and palate present no special variation from the human type. On the hard palate there are a number of folds, or rather swellings, which extend laterally from the central suture of the palate, towards the row of teeth in the upper jaw; these are sometimes simple, sometimes complex, and vary in their details in individual cases. They are particularly marked in the adult chimpanzee, and are also very apparent in the gibbon, and they are arranged with a somewhat ornamental regularity. These inequalities are not altogether insignificant in the human palate, but this subject has not been much studied since Gegenbaur directed the attention of scientific men to them, and special light has been thrown upon it by Bischoff and Ehlers, as far as anthropoids are concerned.

The teeth afford us important material for comparison. In the case of anthropoids the formula for the teeth of the slender-nosed or Old-World apes

(*Catarrhina*) will generally apply: $i\,\frac{2}{2}\;c\,\frac{1}{1}\;p\,\frac{2}{2}\;m\,\frac{3}{3}$. The following is the formula for the milk-teeth: $i\,\frac{2}{2}\;c\,\frac{1}{1}\;m\,\frac{2}{2}$. Magitot and Giglioli* have shown that the milk-teeth are cut in the same order as those of man—first, the lower; second, the upper incisor teeth; third, the front pre-molars; fourth, the back pre-molars; fifth, the canine teeth. According to the same authors, the permanent teeth are cut in the following order:—first, the first molar teeth; second, the lower, and then the upper incisor teeth; third, the pre-molars; fourth, the canine teeth; fifth, the second molar teeth; sixth, the third molar teeth. In the skull of a male gorilla, Giglioli found that the permanent canine teeth were cut almost simultaneously with the third molar teeth, and after the appearance of the second molar teeth. The cutting of the canine teeth appears to be a longer process than that of the other teeth.

In anthropoids the structure of the permanent teeth varies with the species, and even with the sex. In the gorilla the two upper central incisor teeth are wide, chisel-shaped, and much larger than the pair of lateral incisors. The four lower incisor teeth are of about the size of the upper lateral incisors, and, like these, are chisel-shaped, but not so wide. The powerful upper canine teeth of an aged male are curved in their lower part, both outwards and inwards. Their form is that of a three-sided, cuneiform pyramid. The anterior surface is rounded, and near its inner edge a deep furrow may be ob-

* *Bulletin de la Société d'Anthropologie de Paris* (1869), pp. 83, 113.

served, extending from the neck of the tooth almost to its point. The outer and inner sides of the tooth meet in a sharp angle, somewhat convex in front, and level or slightly concave behind. The inner side is concave, and furnished, nearly in the centre, with a deep longitudinal furrow. The lower canine teeth of an aged male are shorter than the upper, curved on their upper and outer surface, and somewhat behind. Their form is also that of a three-sided pyramid, rounded in front. The longitudinal furrow which traverses their inner segment is much shorter than that on the upper tooth. The outer side is somewhat convex, and at the same time somewhat retreating, and is provided on its posterior segment with two longitudinal furrows, or more rarely with one, reaching from the neck to about the centre of the tooth. The inner side, like that of the upper teeth, is somewhat concave. The lower canine teeth project like pillars over the upper ones (Figs. 15, 16). The canine teeth of a young male gorilla are less sharp in their angles, although they already present the form of a three-sided pyramid. The canine teeth of the adult female gorilla are much smaller than those of the adult male, and are laterally more compressed. The three-sided pyramidal form is only slightly marked. The outer surface is convex and furnished with a scarcely apparent central longitudinal ridge. On the inner surface, or that which is turned to the cavity of the mouth, there are from two to three longitudinal furrows reaching from the neck to the centre of the tooth. The lower teeth are of a

three-sided, pyramidal form, presenting an interior, posterior, and inner superficies.

The pre-molars of an aged male gorilla are wide, and are furnished with a large outer, and a smaller inner, cusp. The three four-cusped upper molars display a more regular and symmetrical arrangement of their cusps than is the case with the female, in which the position of the cusps is rather variable. Except for the difference of size, the relative conditions of these teeth are the same in male and female. The first pointed lower pre-molars are in the male of the form of a four-sided pyramid, convex on the anterior and outer surface, flat on the side directed to the cavity of the mouth, and marked with furrows on the posterior surface. The small second and lower pre-molars have two anterior and one posterior cusp. The last is generally worn away at an early age. Each molar tooth has two outer and two inner cusps, opposite to each other, and one posterior cusp. We cannot here fail to notice the likeness to the conditions of the human teeth, a likeness which is still more striking in the female.

In the chimpanzee, also, the upper central incisor teeth are broadly chisel-shaped, while the upper and lower lateral incisors are smaller. In the male there is often a considerable gap between these and the canine teeth. The latter present the form of a three-sided pyramid, of which the anterior edge is blunt and tends outwards, while the posterior angle is sharp, scooped out in its upper third, and terminating at the base of the

crown in a posterior cusp. The pre-molars have an external and an inner cusp; the molars have two external and two inner cusps, connected with each other by their enamel. The lower canine teeth of these animals are likewise of the shape of a three-sided pyramid, of which the anterior angle is very blunt, while the inner and posterior angles are sharply cut. The anterior surface is not grooved like the upper canine teeth. The lateral angle is much rounded. The back teeth plainly display the posterior fifth cusp, which may also be observed in man. In the orang-utan the characteristics of the upper incisors are such as we have described in the case of other anthropoids. The upper canine teeth are shaped like a three-sided pyramid, and are furnished with a longitudinal furrow on the anterior side. A similar furrow is found on the posterior superficies of the lower canine teeth. The back teeth display no special characteristics when compared with those of other anthropoids.

The canine teeth of these anthropoids are much worn down by age on their posterior surface. Deep transverse grooves of varying size characterize the teeth of anthropoids, owing to the unequal distribution of the coating of enamel. These are developed with their advancing growth. In addition to these incised furrows, longitudinal marks, with raised edges, also appear, and especially on the anterior surface of the incisor teeth.

In the gibbon the anterior surface of the incisor teeth is smooth; in this animal the upper central incisor teeth are the largest, while the lower central

incisors are the smallest. The long and strong upper canine teeth, which are laterally compressed, display a sharp posterior angle, and an anterior and inner longitudinal furrow.

It has sometimes been said that the grooves found on the external contour of the back teeth of anthropoids, extending to their roots, constitute a not unimportant distinction between their structure and that of the human teeth, in which the grooves do not extend to the roots. But the corresponding human teeth do sometimes exhibit very deep and extensive furrows. I cannot, therefore, ascribe any peculiar significance to this assumed distinction. The development of the canine teeth, like those of beasts of prey, seems to me much more important. A supernumerary back tooth may sometimes be observed both in man and in anthropoids, including also the gibbon.*

The stomach and intestines of these animals present only a few striking differences from the same organs in man. The length of the intestines varies in man as well as in anthropoids. I have only observed the *valvulæ conniventes* to be somewhat clearly developed in the gorilla and the orang. The cæcum of these apes is long, broad, placed with the power of free movement in the peritoneum, and furnished, especially in the case of the orang, with a large, very long, and spirally coiled vermiform appendix.

The liver is divided into two principal lobes, but

* As, for example, in *Hylobates syndactylus*. Comp. Giebel, *Odontographia*, p. 2: Leipzig, 1855.

in the orang this division is not very clearly marked. I have not myself observed a subdivision of these lobes, occurring on their edges, which is mentioned by Bolau and Auzoux in the case of the gorilla. Bischoff notices in the gorilla the absence of the H-shaped arrangement of the fissures on the under surface of the liver, so noticeable in man; and the same remark applies to other species of anthropoids. Moreover, the fissures on this part of the liver are not incised on the substance with the same uniform depth. The gall-bladder of the gorilla and the orang is not remarkable for its size; in the chimpanzee I found that this organ is large and twisted, and it is also large in the gibbon.

The spleen is elongated in the gorilla, chimpanzee, and gibbon, shorter and wider in the orang. On its left contour it is uniformly bevelled off. There is nothing in the pancreas which calls for remark.

The larynx of anthropoids possesses on the whole a structure resembling that of man. This is especially the case at the entrance to that organ. The anterior and specially vocal portion of the glottis is short, about as long as the respiratory portion. In the chimpanzee there is a deep cavity in the body of the hyoid bone. In the gorilla, chimpanzee, and orang the throat-pouches or air-sacs correspond to Morgagni's sacs. These are the thin-skinned elastic sacs, closely united with their surroundings by connective tissue. The right laryngeal sac appears to be of larger diameter than the left. According to Duvernoy's and Ehlers' accurate account only the upper portion of this organ occurs

in the gorilla. In that animal, and in the orang, a lower projection is displayed, extending behind the sterno-mastoid as far as the shoulder, and another extending to the pectoralis major muscle. In the chimpanzee only the posterior segment is developed. It has been asserted that in several cases there is found a single, irregular laryngeal sac, communicating with the two Morgagni sacs, but I agree with Ehlers in thinking this improbable. In such instances it seems likely that, owing to the great want of symmetry in this organ, one of the sacs has been overlooked. In an aged orang the throat-pouches, fastened together by connective tissue, and covered by the external skin of the throat, hang down slackly and heavily over the middle of the breast (see Fig. 9). According to Sandifort, the siamang is the only one of the gibbons which displays a single throat-pouch; while Broca asserts that it has two detached sacs, placed close to the larynx.* The halves of the thyroid cartilage are generally connected with each other by an intermediate piece.

The trachea of anthropoids generally includes from sixteen to eighteen cartilaginous rings, but in the siamang there are twenty-one. They ramify into branches which are, as a rule, wider on the right than on the left side.† There is a further lateral ramifi-

* *Ortleetkundige Beschryving van een volvassen Orang Oetan. Verhandelingen over de natuurlijke geschiedenis der Neederlandsche Bezittingen:* Leiden, 1840. *Bulletin de la Société d'Anthropologie de Paris,* iv. pp. 368–371: 1869.

† Comp. Aeby, *Der Bronchialbaum der Säugethiere und des Menschen,* p. 7, table v. fig. 11: Leipzig, 1880.

cation on the right side, situated above the artery. Huxley and Ehlers hold that the lungs of a gorilla are cleft like those of the human organism, the right divided into three, and the left into two lobes. I have myself observed this type, and in one instance I found three lobes on the left. In the chimpanzee I saw that the right lung was divided into three, and the left into two lobes. Bischoff observed an instance of a chimpanzee which had four lobes on the right and two on the left side. In an orang dissected by me I found only one lobe on each side, with thin, slightly indented notches on the anterior edges of the right lobe, and two on the left, and there was at the same time a strongly marked indentation between the lobes. The lungs of a gibbon are described as having four lobes on the right, and only one or two on the left. I myself have examined a gibbon in which there were three lobes on the right, and two on the left. It appears that there are not unimportant individual variations of this structure in every species of anthropoids; and indeed, human lungs are by no means exempt from them.

The male sexual organs correspond on the whole with the form and arrangement of these organs in man. I must not omit to mention that the penis of the swine-snouted baboon, and of other dog-headed apes, is much more like the penis in man than is the case with anthropoids, with the exception of the gorilla. In the last-named animal the scrotum is short and tightly stretched. The right testicle is a little higher than the left, and is divided

from it by a wide raphé. The internal female organs are also like those of the human organism, with only slight variations. Bischoff is correct in the assertion that the external lips of the pudendum and the mons veneris are almost wholly absent. Bolau, Ehlers, and Hermes have ascertained that there is a menstruation which occurs periodically, at any

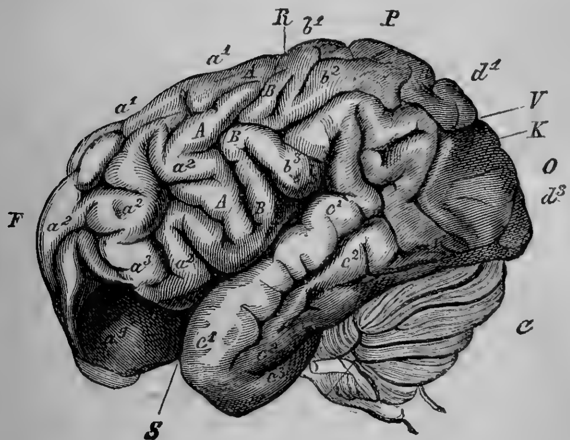

Fig. 56.—The brain of an orang, seen from the side (Vogt, from Gratiolet). F, Frontal lobe. P, Parietal lobe. O, Occipital lobe. R, Fissure of Rolando. S, Fissure of Sylvius. C, Cerebellum.

rate, in the case of the chimpanzee, and the other species cannot be exempt from the process. At such times there is a blush and enlargement of the external parts, and a protusion of the external lips of the pudendum, which are at other times scarcely apparent. The nymphæ and the clitoris are of considerable size and importance. There is often an excessive enlargement and reddening of these

parts, as well as of the posterior callosities in the chimpanzee, and also in the baboon and macaca, during the period of sexual excitement.

Nervous system.—In this part of the organism we are especially interested in the structure of the

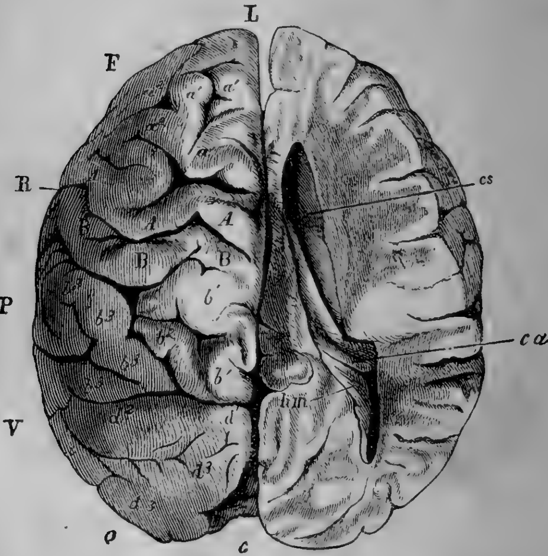

Fig. 57.—Brain of the chimpanzee, seen from above. The upper part of the right hemisphere is removed so as to lay bare the lateral ventricle (Vogt, from Marshall). L, Longitudinal fissure (other indications the same as in Fig. 56). *c s*, The corpus striatum in anterior cornu of the ventricle. *c a*, Hipppocampus major in descending cornu. *h m*, Hippocampus minor in posterior cornu.

brain. Bastian justly remarks, with reference to the brain of apes, that this family possesses many cerebral characteristics in common, by which their close connection with each other may be verified. Distinct stages of development have been

observed, which, however, cannot be classified in a consecutive series. Starting from the brains of lemurs, which do not greatly differ from those of rodents, we can advance by means of very distinct transition forms to the more highly developed cerebral hemispheres of the large anthropoid apes, the chimpanzee, the gorilla, and orang-utan.*

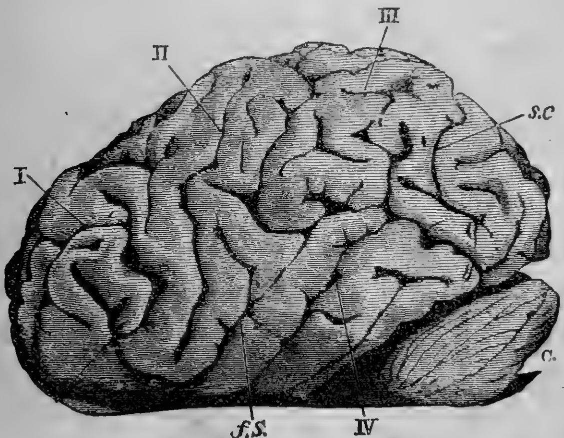

Fig. 58.—Brain of gorilla, side view (from Bolau and Pansch). I., Frontal lobe. II., Tissue of Rolando. III., Parietal lobe. IV., Temporal lobe. C. Cerebellum. *f s*, Fissure of Sylvius. *s c*, External fissure parieto-occipital.

Very opposite views prevail among anatomists with regard to the question which species of anthropoids possesses the most highly developed brain. Some regard the chimpanzee's brain as the simplest, and that of the orang as the most highly developed. In all these apes the lateral halves of

* *The Brain as an Organ of Mind.* International Scientific Series.

the cerebrum, always divided from each other by a deep longitudinal fissure, overlap the cerebellum as far as a minute posterior segment. In this respect I find the brain of the gorilla a little behind the other anthropoids. Up to this time, I have only observed the projection of the cerebellum through the cerebrum in the case of an orang * (see also Fig. 56). Retzius asserts that the cerebellum of Lapps is incompletely covered, while the covering is

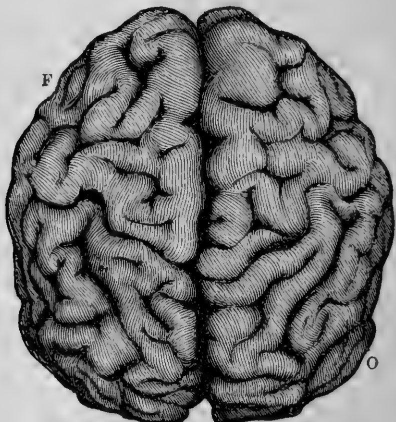

Fig. 59.—Brain of orang, seen from above (Duncan, from a specimen in the Museum of Royal College of Surgeons). F, frontal lobe. O, Occipital lobe.

generally complete in the case of Slav and Tartar races. In German and Latin races the cerebrum overlaps the cerebellum. In Mongolian, Indian,

* Pansch writes of a gorilla's brain: "The cerebellum ought, in a horizontal position, to be somewhat overlapped by the cerebrum." I do not understand what he means by the expression *ought.*

and Negro races the covering appears to be generally imperfect.

While the ground form of the gorilla brain approximates to a long oval, and in this respect resembles the human brain, the brain of chimpanzees and orangs is of a round-oval form. This is especially the case with the chimpanzee (Fig. 57). In my opinion, the gorilla brain is distinguished from that of the chimpanzee, but not from that of the orang, by its very complex convolutions (Fig. 56).

In the gorilla, chimpanzee, and orang, the island of Reil in the fissure of Sylvius is generally—at least, according to my experience—overlapped by the operculum, although there are instances in which this is not the case. In these three anthropoids, as Bastian justly observes, the fissure of Sylvius is much less horizontal than in man, and occupies a position more like that which it takes in the black sea-cat monkey, the wanderers, and other macacas. In the gorilla its direction is more horizontal than in the two other species of anthropoids. The central fissure, termed fissure of Rolando, is very marked, especially in the chimpanzee (Fig. 57 R); but it may also be easily traced in other species of anthropoids (Fig. 58, II., 56, R). The so-called simian fissure between the parietal and occipital lobes of the cerebrum (Meynart's elongated external occipital fissure), presented in Fig. 58 *s c*, is very marked in the chimpanzee (Fig. 57, *d*). The frontal lobes of the gorilla brain are high, while those of the chimpanzee are short and low. It is said that those

of the orang, which are high and short, terminate in a beak-shaped curvature, but this is not invariably the case.

In the anthropoids we have been considering, and also in several of the lower species of apes, there are three other fissures of less importance in addition to those we have mentioned, namely, the fissure parallel to the fissure of Sylvius, and placed behind it, the *corpus callosum* fissure, placed immediately above the *corpus callosum* on the inner side of the

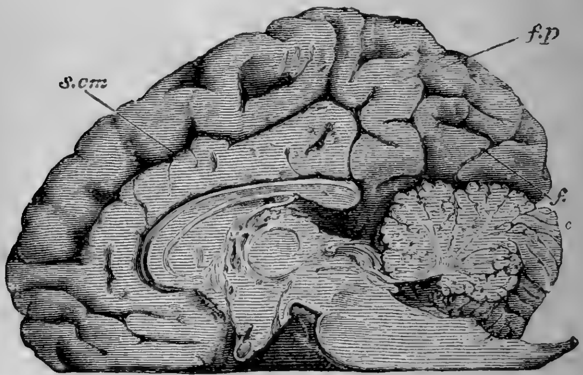

Fig. 60.—Longitudinal section of a gorilla's brain (Bola and Pansch). *s.cm*, Colloso marginal fissure. *f, p*, Internal parieto-occipital fissure. *f, c*, Calcarine fissure, the posterior part of the hippocampal fissure.

hemisphere of the cerebrum, and the calcarine fissure (*Fissura calcarina*) (Fig. 60). The latter ends near the point of junction of the inner and lower surfaces of the posterior division of the hemisphere. The upper temporal convolution, termed by several anatomists *Gyrus supramarginalis*, is said by Gra-

tiolet to be absent in anthropoids; but Rolleston, Bastian, and myself have all found it well developed * (Fig. 56, orang, and Fig. 58, gorilla).

Bischoff asserts that the third frontal convolution (Broca's convolution) is very slightly developed in the chimpanzee, orang, and gibbon. "Its great development in men," Gewährsmann writes, "constitutes one of the most marked distinctions between the brains of apes and of men." † In most of the other species of apes this convolution is altogether absent, but Pansch is justified in the assertion that it is fully developed in anthropoids. I cannot wholly agree with Pansch in his analysis; but I must accept his statement on this point (see the orang, Fig. 59). Gratiolet remarks that the so-called annectant gyri (*plis de passage*) which serve as a covering or *operculum* for the posterior lobes in apes, are only superficially apparent in man. In the chimpanzee the upper of those convolutions is absent, while it is large in the orang, and likewise large and undulated in man. In the orang the second annectant gyrus is covered, but this covering is absent in man.‡

In considering the inner structure of the brain of these animals, we are first struck by the shortness of the *corpus callosum*. The soft and thick anterior commissure of the third cerebral ventricle and the thin posterior commissure have also been justly

* *Natural History Review*, p. 201: 1861.

† *Sitzung der Mathematisch-physikalischen Klasse der königl. bairischen Akademie der Wissenschaften*, p. 100: Feb. 4, 1871.

‡ Gratiolet, *Mém. sur les plis cérébraux de l'homme et des primates.*

noted. In the lateral ventricles more of the characteristics described in the human brain are absent. The four eminences resemble those of man; nor does the fourth cerebral ventricle present any remarkable differences of form. Neither does the base or lower surface of the brain display any important deviation from the human type. The transverse section of the nerves at their intersection appears to me, however, to be somewhat more oval than is the case in man.

There has recently been an attempt to recognize a pithecoid character, or atavism, in microcephalic men, the smallness of whose heads is allied with a greater or less degree of idiocy. A pithecoid structure of the brain has also been traced in several individuals who are not microcephalous, but subject to pathological affections. We will first consider those who belong to the latter category. Krause examined the brain of an ape-like boy aged seven years and a half, which, as the author remarks, approximated in structure to the pithecoid type, although without displaying microcephalic characteristics. The two cerebral hemispheres were wanting in symmetry; they diverged from each other in the region where the parieto-occipital fissure occurs on the left cerebral hemisphere, and they formed an edge which curved outward and backward so that the cerebellum remained uncovered. On the lower surface of the frontal lobes there was a strongly marked ethmoidal prominence. Neither of the fissures of Sylvius were closed, the left less so than the right; the operculum was only slightly

developed; and the island of Reil and its fissures were almost uncovered. This formation is almost the same as that of the brain of anthropoids. The two central fissures of Rolando were close together, or less deeply impressed on the edge of the hemispheres than is normally the case, and forming no joint angle. Large and deeply marked pre-central fissures seemed to represent the central fissures. The intra-parietal fissures, diverging outwardly further than in man, received the parieto-occipital fissure, a structure in conformity with the typical brain of apes. The transverse occipital fissure became in this case a deep fissure like the simian fissure, crossing the occipital lobes, and almost completely dividing them from the parietal lobes. The so-called *Fissura calcarina*, to which we have referred above, had its origin on the upper surface of the occipital lobe, then joined the parieto-occipital fissure, and went directly into the hippocampal fissure (*Fissura hippocampi*) on its right side. This abnormal structure is also in conformity with the typical brain of apes. The first occipital convolution is divided from the upper parietal lobes by the parieto-occipital fissure. Gratiolet asserts that this formation occurs in many species of apes. The upper temporal convolution was remarkably reduced on both sides, possessing only an average width of 5 mm. This characteristic reminded Krause of the brain of the chimpanzee. In that animal the upper temporal convolution is always reduced. Krause therefore asks whether some human brains may not possess the typical structure of apes

without being microcephalic. The brain we have described scarcely differed from the normal weight; it possessed all the convolutions and fissures, and indeed, the convolutions were perhaps more numerous than in the normal structure, yet it was different in every respect, and approximated in its whole structure to the simian rather than to the human type. Krause adds that if the brain had been placed before him without any intimation of its origin, he should have been quite justified in concluding that it belonged to an anthropoid ape, which stood somewhat nearer to man than the chimpanzee.

It is an unquestionable fact that some human beings, whether children or adults, who are endowed with a defective bodily structure, and who are affected with more or less pronounced physical incapacity and mental weakness, by their appearance, ungainly tricks, and helpless and aimless motions, impress us in the most forcible way with their resemblance to apes. Different degrees of idiocy affect individuals of limited intellect, and remind us of an absolutely brutish condition. Krause describes the "ape-like" boy of seven and a half years old, whom he had examined, as cheerful and inclined to play and dance, but as passionate when he was teased. The child was very supple, fond of climbing, and with great strength in his arms and hands, of which the latter had a horny appearance, reminding him of the hands of a chimpanzee. He could sit on the ground with his legs wide apart. His gait was uncertain, and he

was apt to tumble, falling with his knees bent forward and his legs doubled under him; he was fond of hopping, and at such times looked still more like an ape. The great toes of both feet were at an angle to the foot, and thus gave the impression of a prehensile foot. At first Krause supposed that this deviation was produced by the child's endeavour to supply a broader basis of support for his uncertain gait; but he subsequently changed his opinion, since he did not find the same peculiarity in other children of diseased brain, as, for instance, in those suffering from water on the brain. The boy could say very little, only papa and mamma, and it was long before he could pronounce these words in two syllables; for the most part, he only uttered a sound resembling a grunt. He imitated the barking of a dog, with the sound of rolling *r*'s. He often stamped his feet and clapped his hands together, making a grunting noise as Krause had observed in the case of gorillas and chimpanzees. The boy was smaller than other children of his age, and had weak eyes; his head was sore, and his forehead narrow. His imitative tendency was strongly marked, and his whole nature and all his movements strikingly resembled those of apes. He had been much neglected by his parents.*

When I was a student at Berlin I had the opportunity of observing a similar being of twelve years old, in what was at that time the Weinbergswege, near the Rosenthaler Gate. This was a boy with

* *Correspondenzblatt der deutschen Anthropologischen Gesellschaft*, p. 133: 1878.

a large head, a low retreating forehead, glazed eyes, a morose expression, a thin neck, prominent belly, crooked legs, large hands and feet. The boy was of a slouching appearance, and his gait was unsteady: saliva often dribbled from his wide mouth; and as he walked he held on to the furniture, walls, etc., and often he fell powerless on his side, and so remained in a crouching position. It seemed to give him peculiar pleasure to creep on his hands and knees, and at such times he would stamp with the closed fingers of one or the other hand upon the ground, as if in triumph. This habit, his gait, and the gurgling sound which was all that the boy could utter, constituted the points of his resemblance to apes. All the other conditions of life were those of a being whose mental and physical growth was arrested, and who, although not epileptic, was to a certain extent idiotic. I am ignorant what afterwards became of him.

In the course of a discussion on the instance adduced by Krause, Virchow asks whether the psychological conditions of such a brain are indeed simian. He is convinced that whoever has studied the microcephalic child Margaret Becker (of Bürgel, Hanau) will find that psychologically she had nothing in common with an ape. In her case all the positive faculties and qualities of the ape were wanting; the simian psychology was altogether absent, and there was only the psychology of an imperfectly developed and deficient young child. Every characteristic was human. Virchoff had the child in his room for hours together during a period

of two months, and was constantly occupied about her, without observing anything in her nature which reminded him even remotely of the psychological conditions of apes. She was a degraded specimen of humanity, differing in no respect from the human type.*

I also examined Margaret Becker, as well as another microcephalic girl, who was in the Berlin Asylum in the years 1868 and 1869. With respect to the former and more animated being, I have nothing essential to add to the information published by Virchow. Ida X——, the other individual whom I examined at Berlin, was at the time of my researches aged thirteen years and five months. Her figure was slightly made and well proportioned, while her profile reminded me to a modified extent of that of the microcephalic Aztec, and also of the heads represented in ancient sculpture of Mayapan, Palenque, and Copan. I must not omit to say that Ida had light blue eyes and fair, glossy hair. She was altogether impassive; could only utter the syllables *da-da ;* and once betrayed a slight sign of displeasure when the cold metal of the measuring-rod was placed against the inner side of her thigh, for the sake of obtaining the dimensions of the different parts of her body.

Virchow's information respecting Esther Jacobwitz, of Waschahel, is also extremely interesting. She was a microcephalic girl of the age of fourteen, and a Hungarian Jew by race.† Virchow remarks

* *Verhandlungen der berliner Anthropologischen Gesellschaft*, 1877.
† Ibid., p. 25 : 1878.

that, in his opinion, all Esther's most striking characteristics presented the strongest contrast to those of apes, since only negative traits have hitherto been established, while all which characterizes the positive development of the psychical life of apes was absent in this case. The same remark applies to Ida X——. Virchow goes on to say that there was undoubtedly something brute-like in the defects in question, but that in order to reproduce the animal in its actual form and nature, so as to show that the microcephalic child was really theromorphic, the positive side of animal life must to some extent be presented to us, and this was absolutely wanting.

Virchow also had the opportunity of examining a pair of twin children, one of whom was quite normally developed, while the other (Karl R——) was microcephalic. This was a very significant case, since two individuals of the same birth were under consideration, so that the question could be asked with greater confidence—Is this atavism, or a morbid condition? From this point of view, it was of special interest to establish the fact that the microcephalic child had, in fact, displayed positive signs of a morbid condition.*

When I go through the accounts collected by C. Vogt of the lives of well-known microcephalic beings,† I can find nothing which specifically reminds me of the actions and habits of apes, although we have an intimate acquaintance with their ways. These individuals give the general

* *Vehandlungen der berliner Anthropologischen Gesellschaft.* p. 28: 1878.

† *Archiv. für Anthropologie*, p. 129: 1867.

impression of human beings whose bodily and mental development has been arrested. According to Virchow's experience, all the cerebral disturbances are concentrated in the cerebrum in these microcephalous cases. The anterior portions of the cerebrum are affected to the greatest, and the posterior to the least, extent. Those parts which are developed latest suffer the most, while those which are the first to be developed generally escape disturbance.*

Klebs, Schaaffhausen, and others have sought to show that the mothers of microcephalic children have suffered from severe pains of the uterus during pregnancy. All scientific men consider that spasms of the uterus distinctly affect the development of the brain of the offspring. Flesch thinks it possible that these spasms of the uterus may have something to do with the origin of microcephaly.† But he also asks whether this morbid condition of the uterus may not have been produced by a previously diseased condition of the offspring. This observer is, moreover, still more inclined to make the influence of the father responsible for the occurrence of microcephaly. In view of the fact that there is much reason to suppose there has been a compression of the uterus, and in default of any better suggestion, Flesch feels justified in looking for a compression which has

* *Verhandlungen der berliner Anthropologischen Gesellschaft*, p. 283 : 1877.

† *Correspondenzblatt der deutschen Anthropologischen Gesellschaft*, p. 134 : 1877. H. Gerhartz, *Ueber die Ursachen der Microcephalie.* Inaugural dissertation. Bonn, 1874.

perhaps resulted from some growth on the ovary. Hence ensues a disturbance, probably inflammatory, of the organ of nutrition.*

Aeby also regards microcephaly, not as an expression of atavism, but as the result of a morbid degeneration. "Microcephalic subjects do not point back to the milestone which man left behind him in hoar antiquity, and it is not through them that the chasm between man and animals can be bridged over, nor even rendered less wide."

Virchow's researches led to the following conclusions, which we must here subjoin:—1. There is no species of apes which presents that precise configuration which is found in a microcephalic brain. 2. Psychology offers the strongest arguments against men-apes. 3. The instinctive side of psychical activity, which is almost wholly absent in microcephalic subjects, is very prominent in anthropoids as well as in other animals.†

In addition to these remarks, it may also be observed that among savage races the medicine-men, shamans, sorcerers, rain-doctors, etc., often assume ape-like attitudes in the contortions, leaps, dances, and other gestures which are inseparable from their trade. Owing to their state of excitement, in which they are not always mentally responsible for their acts, this imitation may be often partly or wholly

* *Anatomische Untersuchung eines Microcephalen Knaben.* Reprint of a paper written for the celebration of the three hundredth year of the University of Wurzburg, p. 27.

† *Verhandlungen der berliner Anthropologischen Gesellschaft,* p. 248: 1877.

unconscious. It is very common among the inspired Arabs termed Haschasch, who, sometimes as dervishes, sometimes as poets or beast-tamers, roam through the country and extend their wanderings from the interior of Africa to the latticed gates of Dolma Bakhtsche. To them belong also the dancing mendicant monks of Islam, who display their ape-like gesture in the market-places and streets of Bokhara, as well as in the other chief cities of Central Asia. In this case, indeed, many gestures are conventional, and even adopted as the means of stimulating the proposed effects, but at the same time they impress us with the idea that a man under such conditions of life and work involuntarily adopts the gestures of anthropoids. When we see a Zikr, an Islamite rite of worship, accompanied by obligatory howls and contortions of body, we are tempted to imagine ourselves in the midst of a troop of wild apes. And the illusion is still stronger if the performers in the Zikr are black fakirs, dressed as warriors.

The peripheral nervous system of anthropoids has not, up to this time, been analyzed with the completeness we could wish. As far as the observations of Vrolik, Gratiolet, and Alix go, together with my personal experience in this department, no marked distinction can be established between the structure of these organs in anthropoids and those of the nervous system in man.

H. von Ihering has studied the relation of the nervous lumbo-sacral plexus to the vertebral column of men and animals, and has come to the conclusion

that there is the most complete agreement between men and animals with respect to the relations of the vertebral column to the peripheral nervous system. According to this author, man, from the anatomical point of view, stands so completely within the class of anthropoids, that the attempt to assign to him any other place in zoology is open to the charge of being biassed by considerations which have nothing to do with facts.*

The organs of the senses in anthropoids do not present any noteworthy points of difference from these organs in man. I have written, but not yet published, a treatise on the eyes of these animals, showing their general agreement with the conditions of the human eye. On the skin of the fingers and toes of anthropoids developed corpuscles may be detected which are connected with the sense of touch.

The vascular system of anthropoids has not up to this time been studied in any exhaustive manner. The heart strongly resembles that organ in man. In the gorilla, the chimpanzee, and the orang the great arterial branches have the same relative conditions as in the human organism. A common origin from one branch of the subclavian artery, and of the right and left carotid arteries, often occurs in the orang and with a certain constancy in the gibbon, so far as we can judge from the researches which have been made up to this time. But we know that this form of deviation from the common type is not

* *Das peripherische Nervensystem der Wirbelthiere*, p. 219: Leipzig, 1878.

altogether rare in man. Bischoff and others have justly maintained that the resemblance to man which is found in these animals in the arrangement of the heart and larger blood-vessels appears to be connected with their mode of life. For although their habits are arboreal, this very fact implies that they are for the most part in an upright position.

The division of the femoral arteries displays a somewhat interesting deviation from the normal human type. High up near the femoral arch an artery, accompanied by veins and a large nerve, diverges from the femoral artery, which extends, together with its accompanying parts, as far as the back of the foot. In the gorilla this branch pierces the sartorius.

CHAPTER IV.

ON VARIETIES IN THE FORM OF ANTHROPOIDS.

Up to recent times it was generally supposed that there was only one species of gorilla, and the differences in the structure of the skeleton and of the external body which were observed in the several specimens under examination, were either regarded as the expression of a purely individual variation or as due to differences in age and sex. Not long ago Alix and Bouvier obtained from Landana on the Congo the skeleton and skin of an aged female gorilla, which had been killed by Lucan and Petit in the village of the negro chief Mayema, on the Kuilu river in 4° 35′ south latitude. This specimen was of less bulk than the common gorilla (*Gorilla Gina*), and its head was comparatively small. The occipito-temporal crest, or transverse crest of the occiput, was much more strongly developed in this animal and the temporal fossæ were deeper. That part of the skull which extends behind the supra-orbital arches was narrower, and so also was the space between the eyes. The keel-shaped prominence rising in the

centre of this space is more marked, the nasal bones are arched and not flattened, the orbital aperture is larger in comparison with the general size of the skull, and the frontal processes of the malar bones are wider and more arched. One interesting characteristic consists in a small, vertical, styloid prominence on the posterior surface of the orbital process. On the vertebral column the spinous processes of the first, second, and third cervical vertebræ are only slightly developed in height, while the spinous processes of the three lower cervical vertebræ are as high and large as those of *Gorilla Gina.* The transverse processes of the first lumbar vertebræ are remarkable for their length, and in their transverse extension reach almost to the angle of the last rib.

In this supposed variety of the gorilla the iliac crest is more convex, the tuberosity of the ischium is somewhat more everted, the neck of the femur is more oblique, the os calcis is slenderer, and its lower surface is more arched. The clavicle appears to be shorter and less curved: the scapula is more arched near its inner border; its outer border is distinctly concave, while in *Gorilla Gina* it is prominently convex. The base of the acromion process is larger, and the olecranon fossa of the humerus is perforated. The bones of the forearm and hand, as well as of the shank and foot, are more slender, and their prominences and inequalities are less marked. The smaller bulk of the fore and hind limbs corresponds with the comparative smallness of the head.

The colouring, grey and brown on the trunk,

black on the limbs, with red patches on the head, and reddish in the pubic region, does not essentially differ from that which has been described by different authors in the case of other skins which have indeed been artificially restored. But the hide essentially differs from that of other specimens in the sharp division of the brown colouring of the belly from the grey of the back, by the reddish tint of the hair which clothes the pubic region, and also in the abundant growth of hair which so closely encircles the cheeks and chin. But, according to our authorities, the most remarkable difference consists in the fact that the whole of the back is covered with long, thick hair, while in *Gorilla Gina* this part is either bare or only covered with short hair, partly worn away. Hence these authors conclude that this species, which they assert to be new, and have named *Gorilla Mayema*, from the negro chief of that name, does not rest its back against a tree so often as the *Gorilla Gina*, but leads a more arboreal life, climbing from tree to tree.*

I admit that if I were to take into account all the individual differences of the gorilla skulls and skeletons of the same sex and of about the same age, I should be able to produce a half-dozen or more species of gorillas. I have observed such differences in the case both of male and female individuals of about the same age, and have given an exact description of them in my osteological work on the gorilla to which I have so often referred. I cannot, however, refrain from regarding these

* *Bulletin de la Société Zoologique de France*, p. 1: 1877.

differences as of a purely individual character. Much in the description by Alix and Bouvier—as, for instance, their remarks on the comparative smallness of the head, on the slenderness and smoothness of the limb bones—appears to me to point to the youthfulness of this Landana specimen. The unlearned may be struck by what is said of the small spinous processes of the upper cervical vertebræ in this specimen, but in the common gorilla the processes of the three upper vertebræ are also small (see Fig. 17). Individual and sexual variations in the general development of the cervical spines may be observed, not only in this case, but in the chimpanzee, and even in man. I think it very doubtful whether a characteristic of species can be founded only or chiefly on this distinction. What is said of the colouring of the coat of the so-called new species appears to me still less worthy of consideration. I have spoken above in detail of the many individual varieties of the colour of the hair in different specimens of gorillas. I have also observed long, thick hair, not always short, scanty, and worn away, on the backs of many gorillas of different sexes. The condition described by Alix and Bouvier must refer to the hides of aged and sickly animals, or to those younger individuals affected by the kind of mange which is widely diffused in Africa. Every gorilla delights to rub his back against the trunk of a tree, and leans against it in a contented mood, and so also does the chimpanzee. This is the habit of many other mammals, such as cats, lions, boars, deer, and elephants.

Man himself will sometimes adopt such an attitude. Without more convincing proofs that *Gorilla Mayema Alix et Bouvier* constitutes a distinct species, I should prefer to leave the matter in suspense.

I frankly admit that I am more doubtful how to decide the question whether we can at present assume that there are several or only one species of chimpanzees. *Troglodytes niger* has always been regarded by me as to a certain extent a typical form of this animal, and in the second chapter of this work I selected it as the subject for my general description. It is this type of chimpanzee which has usually reached Europe from the West Coast of Africa. The face of this animal is moderately prognathous; the head, even in aged males, is round, the ears are large and of somewhat the form presented in Fig. 6, the skin is of a dirty flesh-colour, and the hair is black. Reichenbach's *Pseudanthropos (Troglodytes) leucoprymnus* * is only so specified on account of the whitish hair which clothes its posterior—a character observed in all true chimpanzees, and therefore without specific value. Lainier, the keeper of the Museum at Havre, has had an illustration made from a damaged skin of a large (probably male) chimpanzee; but we can only form an imperfect opinion of its general external appearance from this figure.† There is as little certainty about Gray's *Troglodytes vellerosus* from

* *Die Vollständigste Naturgeschichte der Affen*, p. 191: Leipzig and Dresden.

† See Chenu, *Encyclopédie d'Historie Naturelle, Quadrumanes*, p. 34.

the Kamarum mountains.* Duvernoy's remarks on *Troglodytes Tchégo,* which he asserts to be a new species, relate to an aged male specimen of which the form is also doubtful.

From the materials brought home by Du Chaillu, Jeffries Wyman has sought to establish two new species of anthropoids, the Nschiego Mbouvé (*Troglodytes calvus*) and the Koolo-Kamba (*Troglodytes Koolo-Kamba*). I have vainly endeavoured to obtain a satisfactory account of these two supposed new species from the descriptions which are intended to establish them. The whole matter is unfortunately rendered more confused by the illustrations he subjoins. That of the Nschiego Mbouvé is only taken from a very badly stuffed skin of a chimpanzee, that of the Koolo-Kamba from the skin of a female gorilla. But we may come to the general conclusion that there are, in fact, not inconsiderable, and perhaps even specific, variations from the ordinary type of chimpanzee.

Much was said in the years 1875 and 1876 of the female ape Mafuca (often erroneously termed Mafoca), which was brought from the Loango coast and placed in the Zoological Gardens at Dresden. This was a wild, unmanageable creature, 120 cm. in height, reminding us in many respects of the gorilla. The face was prognathous; the ears were comparatively small, placed high on the skull, and projecting outwards; the supra-orbital arch was strongly developed; the end of the nose was broad; and there were rolls

* Catalogue of Monkeys, Lemurs, and Fruit-eating Bats in the British Museum. Appendix, p. 127: London, 1870.

of fat on the cheeks. The creature was, moreover, strongly built, and the region of the hips and the belly were contracted, while the hands and feet were large and powerful. When I first saw this

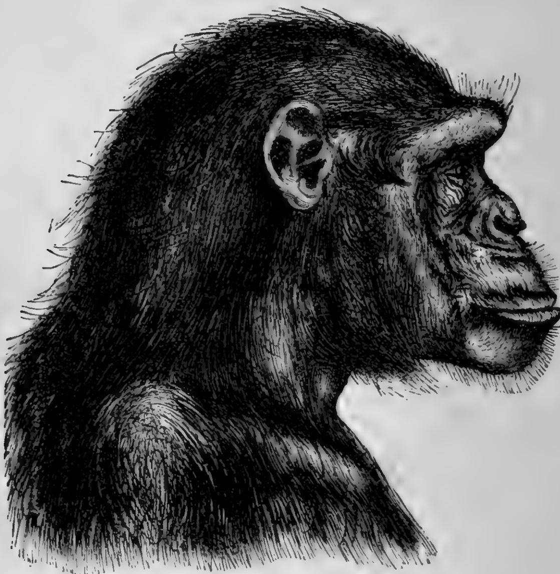

Fig. 61.—Mafuca.

savage creature, early in September, 1875, it was full of vigour, and I was almost convinced that I saw a female gorilla, not quite adult, an opinion shared by such zoologists as K. Th. von Siebold and others, while it was vehemently opposed by Bolau and A. B. Meyer. At that time I made a drawing of its profile, which is given in Fig. 61, and which was taken at a moment when the animal happened

to be resting from its wild gambols. In spite of some slight errors,* the illustration faithfully reproduces its general and quite original character, and especially the expression of its countenance. From the structure of the brain Bischoff attempted to show that this animal was simply a chimpanzee. No rational explanation can be attached to this suggestion.

If, while Mafuca was still alive, I had examined the dead body of the female gorilla of which I have already spoken, and which was of about the same age, I should have been still more disposed to regard Mafuca as a true gorilla. The general physiognomical resemblance between these animals was very great. As I have mentioned in detail in my earlier works, the female gorilla had a high upper lip, and a somewhat small nose. Mafuca's upper lip is undoubtedly still higher, but otherwise the physical correspondence between the two animals is very great. The hands of the female gorilla are still broader than those of Mafuca; and indeed, Brehm proposes to classify the latter animal as a new slender-handed species of anthropoid. The assumption which I have already contested in the earlier pages of this work, that the female type should be placed in the foreground in describing the species, is especially untenable in the case of the

* For example, the ears are represented as somewhat too small. Although the growth of hair on the crown of the head makes them look larger, the want of proportion must be admitted. It might easily have been altered, but I preferred to reproduce the original sketch as it stood.

gorilla, in which the male character is extremely predominant.

To what species, then, did Mafuca belong? A cross between the gorilla and the chimpanzee was often suggested at the time. I was myself inclined to take this view, and it was advocated by C. Vogt in his contemporary treatise on the subject, as well as in the magnificent work which has lately appeared, remarkable for the beauty of its illustrations and the genius of its style.* H. von Koppenfels heard much of such crossings when he was on the Ogowe, nor is their occurrence by any means impossible, and indeed they have been directly observed among other species of apes while in confinement. Koppenfels also affirmed that he had shot two such cross-bred animals, which were associating with a troop of gorillas. The traveller sought to kill others of the troop, but, when creeping on hands and knees through the thick bushwood, he was constrained to retreat by the attacks of some stinging ants (*Anomma arcens*). The skins and skeletons of the supposed cross-breds were brought to the Natural History Institution in Dresden. A. B. Meyer observed that the traveller was mistaken in these instances, and that the remains sent by him to Europe were undoubtedly those of chimpanzees.† It must be remembered that Kop-

* *Die Säugethiere in Wort und Bild.*, by C. Vogt and Specht, p. 11: Munich, 1882.

† *Mafoca Betreffendes.* Reprinted from the reports of the *Gesellschaft für Natur und Heilkunde zu Dresden*, Sitzung, xxvii. p. 9: 1876.

penfels was a clever hunter, and on the whole a good observer of nature, but that he was no zoologist, and may have been mistaken as to the nature of the animals he had shot. At the same time the possibility of the existence of such cross-bred animals cannot by any means be disputed. Meyer must be convinced that his assertion cannot be generally accepted: "Any consideration of the question as to cross-breeding is like fighting with windmills—that is, making difficulties where none exist."

If the trophies of von Koppenfels' hunting are merely chimpanzees, it is, at any rate, very interesting to learn that these animals were found in the company of gorillas. We must hope that scientific travellers will in future feel bound to devote their special attention to this question.

In the end of June, 1876, von Falkenstein, who was attached to Güssfeldt's Loango Expedition, brought from Chinchoxo to Berlin a female chimpanzee, Paulina, which varied a good deal in countenance from the chimpanzees we have commonly seen. The ears projected widely in a lateral direction, the supra-orbital arches were prominent, the nose was wide, the colour of the skin dark and blending into russet. I have seen chimpanzees, both living and dead, which reproduced these characteristics of Paulina with more or less distinctness. I have nothing to urge against those who wish to regard such individuals as the representatives of a special variety. I would only warn them against the risk of accepting as such the species entitled by Du Chaillu and

Wyman, *Trolodytes Koolo-Kamba,* which appears to be ill-established.

An attempt has been made, chiefly by the unlearned, to regard Paulina as the image of Mafuca. There is, however, a considerable physiognomical difference between the two animals. For me and many other naturalists Mafuca remains up to this time an enigma, which is slurred over by others with the help of a few phrases. Paulina, on the other hand, and animals of the same character, display much to remind us of the illustration given by Gratiolet and Alix of their *Troglodytes Aubryi,* although the drawing was taken from a specimen dissected by the French naturalists which had lost its hair through maceration in an impure preserving fluid. The growth or the lack of hair involves considerable external differences in specimens of these animals, yet I repeat my assertion that there is a resemblance between Paulina and her fellows, and Aubry's chimpanzee.

The certain special characters presented by chimpanzee forms here mentioned (Paulina and *Troglodytes Aubryi*) remind us of the bam found on the Niam-Niam in Central Africa, which was probably first discovered by A. de Malzac, and was afterwards more exactly described by Schweinfurth.

In *Cassell's Natural History* (i. 39) the Nschiego-Mbouvé (*Troglodytes Tschégo Duvernoy ; Troglodytes calvus Du Chaillu et Wyman*), is described and drawn by Duncan, but only in profile, from a stuffed specimen. In this there is much to remind us of the profile of Mafuca, including the very shrivelled

nose. An illustration is given in the same work of the anthropoid Koolo-Kamba, here given as a distinct species, and identified in the systematic catalogue as *Troglodytes Koolo-Kamba,* together with *Troglodytes Aubryi ;* here we see a full-grown chimpanzee of the ordinary kind, to which a front view of the head of the Aubry chimpanzee, as it was published by Gratiolet and Alix, has been affixed. Honest research should stand aloof from such confusion. By Brehm, the Mafuca was given as the representative of the species already established by Duvernoy, *Troglodytes Tschégo* or *Anthropopithecus,* and this assertion is accepted by Martin.* The latter remarks that this ape cannot be classified either with the chimpanzee or the gorilla, and gives some reasons for his assertions.

In my opinion it is a difficult question to decide whether there are several or only one species of chimpanzee. As things are at present, my conviction is strengthened that it is only possible to make a provisional settlement, and I am able to admit a certain constancy in the varieties of chimpanzees. First, The original representative of the species (*Troglodytes niger,* Is. Geoff. Saint-Hilaire). This animal has a round head, and the supra-orbital arches are strongly developed in the male, more slightly in the female ; the countenance is not very prognathous, and has an angle of 70 degrees ; the ears are from 75 to 78 mm. in height ; and the whole height of the body varies between 1100 and 1300 mm.

* *Thierleben,* ii. 80, 81. *Illustrirte Naturgeschichte des Thierreichs,* i. 11 : Leipzig, 1880.

The face, hands, and feet are of a dark reddish flesh-colour, or rarely of a blackish brown or speckled general colour. The hair is either wholly black or black shot with reddish brown. Second, Another variety, bam or mandjaruma (*Troglodytes niger varietas Schweinfurthii Giglioli*). The head of this animal is somewhat long, the supra-orbital arches are only slightly developed, the nose is wide, and the upper lip rather low in comparison with the other variety; the ears are somewhat smaller, and the face is more prognathous, with an angle of 60 degrees. The limbs of this variety are slenderer, yet still strongly developed. The skin is of a dark reddish flesh-colour in youth, and with the increase of physical development it becomes a reddish brown, dark brown, or blackish. The hairy coat is black, shot with reddish or dark brown, or sometimes of a reddish brown colour, tipped with tawny or yellowish grey, especially on the back. To this variety the mandjaruma belongs, of which an illustration is given by von Issel, and also the portrait taken from life of Paulina of Loango, which is given in my osteological work on the gorilla,* as well as *Troglodytes Aubryi* (?), and similar animals, of which I have given illustrations in the *Archiv. für Anatomie.*†

The question might now be raised whether we may assume that there is any distinct species of anthropoids intermediate between the gorilla and the chimpanzee. As such, we may perhaps regard

* *Der Gorilla*, vi. p. 25. The inscription to this fine cut erroneously gives this as a male instead of a female specimen.

† Series for 1876, plate vii. figs. 2, 4.

Du Chaillu's *Troglodytes Koolo-Kamba*, Duvernoy's *Troglodytes Tschégo*, the large stuffed animals in the Museum at Havre, and the heads of which I have given illustrations in the *Archiv für Anatomie*, plate vii. fig. 1 (1875); and in the *Zeitschrift für Ethnologie*, p. 121 (1876). Perhaps Mafuca and the ape which Livingstone found in Manyema might also be included.* Duvernoy's name for the species, *Troglodytes Tschégo*, seems to me not quite suitable, since the West African chimpanzees in general are distinguished by that Latinized specific name. However, this scientific term may be accepted in default of a better, until we are enabled by the possession of more abundant materials to establish the existence of such an independent species.

With respect to the orang the unity of species is also not yet ascertained. The Malays of the country to which they belong assert that there are different forms of this animal, which go by the general name of meias. The descriptions current among that people respecting these varieties are surprising. We are tempted to believe in the existence of different species, and some zoologists, Brühl among others, hold that there are, at any rate, two such species. Wallace, who is intimately acquainted with the species, says nothing on this point in his work on the Malay Archipelago, but it seems to appear from his general remarks that he is disposed to recognize only one species of this animal. There are, perhaps, constant varieties, limited to different places, and the

* *Livingstone's Last Journals in Central Africa from* 1865 *to his death,* ii. 52–55: London, 1874.

future will throw more certain light on this question. It is better, therefore, to leave it in abeyance, instead of indulging in peremptory and unnecessary negations. With respect to the gibbon, the question of variety of species has been long decided.

CHAPTER V.

GEOGRAPHICAL DISTRIBUTION, HABITS IN A STATE OF NATURE, AND NATIVE NAMES OF ANTHROPOIDS.

THE gorilla inhabits the forests of West Africa, between lat. 2° N. and 5° S., and long. 6° and 16° E. They are most widely diffused in the northern part of this territory, on the rivers Ogōwē, Gaboon, and Danger. Ford asserts that these apes are chiefly found in the chain of mountains which extends for about a hundred miles from the coast of Guinea, between the Camaroon and Angola, and which is known as the Serra do Cristal. They have also been found at the source of the Danger (Muni, Mooney). In Ford's time, about 1851, he saw them half a day's journey from the mouth of that river. In the years 1851 and 1852 gorillas were seen in large numbers on the sea-coast, probably driven thither from the interior by a scarcity of food. At that time four or five specimens were obtained in the course of a few months. After this they again completely disappeared from the neighbourhood of the coast, so that an American merchant captain offered 6000

dollars for a live specimen without being able to obtain it. According to H. von Koppenfels, the gorilla inhabits the district which lies between the mouth of the Muni and that of the Congo.

According to Pechuël-Lösche, the gorilla is rare on the Loango coast. In this district it inhabits the mountainous forests or the strip of country in their immediate vicinity. Some years ago these apes were found on the Luemme and Kuilu, even down to the mouths of these rivers, and also in the ravines of the plateau of Buala; but they now only come to the coast at Banya, where the same authority believes that he once heard gorillas. Neither Pechuël-Lösche, Falkenstein, nor Güssfeldt have ever seen the species in its wild state.* The specimen brought to Berlin by these travellers in 1876 was obtained by Falkenstein in October, 1875, at Ponta-Negra on the Loango coast, where it was presented to him by the Portuguese trader Laurentino Antonio dos Santos. This animal, which was then extremely young, had been brought from the Kuilu district by a negro, who had shot its mother.†

In earlier accounts given by Owen, the district most frequented by gorillas was in the region of the Gaboon, which presents a pleasant variety of hill and dale. Here the high ground is clothed with fine, tall trees, while the valleys are rich in grass, with a scattered growth of underwood. There are a number of trees and shrubs, bearing fruits which the natives find inedible, but which are greedily de-

* *Die Loango Expedition*, Abth. iii. p. 248: Leipzig, 1882.

† Ibid., Abth. ii. p. 150.

voured by gorillas. They show a special preference for the following fruits:—First, those of the oil palm (*Elaeis guineenis*), of which they also devour the developed, folded leaves, called the palm-cabbage; second, the grey plum tree (*Parinarium excelsum*), which bears a mealy and insipid stone-fruit; third, the melon tree (*Carica Papaya*); fourth, the pisang (*Musa paradisiaca, Musa sapientum*); fifth, two sorts of scitamines (*Amomum granum paradisi s. Afzelii, Amomum malaguetta*), the last of which, according to Lindley, produces the malaguetta pepper; sixth, *Amomum grandiflorum;* seventh, a tree bearing a walnut-like fruit, of which the gorilla cracks the shell with a stone (this is probably one of the *Sterculiaceæ*, like the Kola-nut); eighth, another tree with which we are not yet botanically acquainted, bearing a cherry-like fruit. Du Chaillu asserts that these animals are also very fond of sugar-cane and the wild pine-apple. Although they live in places far from human habitations, yet they rob the cane-plantations and the rice-fields of the negroes in the harvest-time, and this is a fact confirmed by Koppenfels. Savage reports that gorillas also devour the bodies of animals killed in hunting, and even human bodies, and this does not sound improbable. Like most species of apes, the gorilla preys upon the smaller mammals, upon birds and their eggs, and upon reptiles. The gorillas which have been kept in confinement at Berlin have been quite omnivorous, and have displayed a special taste for animal food.

In the little village of Ntondo, near the Kuilu,

Güssfeldt saw a fetish called Bunsi, constructed of the skulls of animals, and quite peculiar to Bakunya-land. It consisted of a pile of the skulls of animals which had been slain in hunting, and which were brought as an offering to the fetish by the hunter in order that his good luck might be maintained. The heap consisted for the most part of the skulls of antelopes, buffaloes, and wild boars, but there were also many skulls of gorillas. Among these Güssfeldt saw two fine specimens with high bony crests. When he inquired where gorillas were found and killed, the natives of Ntondo pointed to a neighbouring forest.*

Güssfeldt describes the character of the forest of Mayombe, where gorillas are also found, somewhat as follows:—This forest does not correspond to our idea of a primeval tropical forest, and would perhaps perplex a South American traveller, since it is more like the forests of mountainous districts in Germany. The luxuriant growth of lianas is characteristic of a tropical primeval forest: they form a second roof of leaves above the green masses of the closely set trees. But in this case the parasitic vegetation is scanty, although not wholly absent, as the kautschukranke (*Landolphia florida*) shows, which was at one time very abundant, but is now nearly extinct. Its growth no longer obstructs the view of the tall and slender trees, somewhat resembling beeches. The underwood of our German forests is here chiefly supplied by the large linear leaves of the scitamines, of which the most common variety is

* *Die Loango Expedition*, Abth. i. p. 123.

termed matombe by the natives. Ferns, or rather tree-ferns, are not wanting, and the ground is covered with dead leaves. The trees of this forest have been untouched by the axe, except in places cleared for the construction of a new village. Where a tree falls there it lies, encumbering, as it may for years, the narrow path which leads through the thicket. An eternal twilight always prevails here, and on cloudy days it might be supposed that the sun was eclipsed. The atmosphere is close and damp, like that of a hothouse, and its weight is most depressing to mind and body. The dense stillness is rarely broken by the wailing cry of a bird, and no wild creature can be seen. Those who wander in these forests are always going up or down hill, since there is no level ground, and by paths scarcely wide enough for a white man, which are covered with smooth and slippery roots, while the feet and clothes are constantly caught by boughs and lianas, which also sting the face, so that the traveller longs for free, unimpeded motion, for light and air, and rejoices to see the cleared space on which the village of Bayoma stands, surrounded by palms and bananas.* In the work I have quoted on the Loango Expedition, a fine water-colour drawing, by Pechuël-Lösche, of a forest frequented by gorillas is reproduced, and I subjoin a copy of this interesting illustration (Fig. 62).

The gorilla lives in a society consisting of male and female and their young of varying ages, and the family group inhabits the recesses of the

* *Die Loango Expedition*, p. 103.

Fig. 62.—The home of the gorilla.

forest.* According to von Koppenfels, they frequent the same sleeping-place not more than three or four times consecutively, and usually spend the night wherever they happen to be when night comes on. Koppenfels differs from other narrators in the assertion that the gorilla constructs a bed for his night lair upon the trees. He chooses for this purpose a full-grown tree, not more than 0·30 m. in thickness, breaks and bends the branches together at a height of from five to six metres from the ground, and covers them with the twigs he has torn off, or with the leaf-moss, which grows scantily in this part of Africa. The male animal spends the night crouching at the foot of the tree, against which he places his back, and thus protects the female and their young, which are in the nest above, from the nocturnal attacks of leopards, which are always ready to devour all species of apes.

In the daytime the gorillas roam through the tracts of forest which surround their temporary sleeping-places, in order to seek for food. In walking they place the backs of their closed fingers on the ground, or more rarely support themselves on the flat palm, while the flat soles of the feet are also in contact with the ground. The toes are generally extended, and a little separated from each other, but occasionally they are doubled under. Their

* The account given by H. von Koppenfels, whose early death we must all deplore, is taken from his article in the *Gartenlaube* (1877, No. 25); from his correspondence with his family, which I have been allowed to see; and from a long paper addressed to Professor Bastian from Adulinalonga, dated March 26, 1874.

gait, as Huxley justly observes, is tottering; the movement of the body, which is never in an upright position as in man, but bent forward, rolls to some extent from one side to another. As their arms are longer than those of the chimpanzee, they do not reach out so much; but the gorilla also throws his arms forward, sets his hands upon the ground, then gives a half-swinging, half-springing motion to his body. When assuming the position for walking, the body is much sloped, and its great bulk is so balanced as to bend the arms upwards. In spite of his apparently clumsy and unwieldy form, the gorilla, like the bear, displays great bodily dexterity. He is a very skilful climber, and, as Koppenfels asserts, when ranging from tree to tree, he will go to their very tops. He first tries whether the branches will bear his weight, and if one branch is not strong enough, he makes use of three or four at once. He will also run along the branches on all fours, stepping warily. Koppenfels saw a full-grown animal, as danger approached, spring down from a tree which was thirty or forty feet high, and then hastily crash through the brushwood. All Huxley's informants concur in the assertion that there is only one adult male attached to each group. As soon as the young male reaches maturity, a conflict for the mastery takes place, and, after his rival is killed or driven away, the stronger animal becomes the head of the community.

I have already spoken of the diet of the gorilla. Koppenfels once observed a male and female with two young ones when they were feeding. The head

of the family remained at his ease, while his wife and children plucked fruits for him from a small tree which stood by, and if they were not sufficiently nimble, or if they took too large a share for themselves, the old gorilla growled furiously and inflicted a box on the ear.

The gorilla is regarded as a dreadful and very dangerous animal by the negroes who inhabit the same country, and who themselves are often deficient in spirit, while their tales of exaggerated horror serve to increase their scanty fame as hunters. And what even the luxuriant fancy of negroes could not paint as sufficiently terrible has been exaggerated by Du Chaillu for the benefit of his readers. We will not here repeat these bloodthirsty tales, of which Brehm justly says that they seem to have been devised by an indifferent romance-writer, who has given his pen free play.* In the letters to Bastian, which are in my hands, Koppenfels has endeavoured to modify the accounts of the alleged ferocity of the gorilla. This appears in the fragment of poetry given by that esteemed traveller in one of his letters.

The same author writes in another place: "As long as the gorilla is unmolested he does not attack men—and indeed, rather avoids the encounter." These apes generally utter deep guttural sounds, sometimes protracted like *kh-eh, kh-eh,* sometimes roaring or growling. When the animal is scared by man, he generally takes to flight screaming, and he only assumes the defensive if wounded or driven

* *Illustrirtes Thierleben,* i. 17 : Hildburghausen, 1864.

into a corner. At such times his size, strength, and dexterity makes him a by no means despicable enemy. He sends forth a kind of howl or furious yelp, stands up on his hind legs like an enraged bear, advances with clumsy gait in this position and attacks his enemy. At the same time the hair on his head and the nape of the neck stands erect, his teeth are displayed, and his eyes flash with savage fury. He beats his massive breast with his fists, or fights the air with them. Koppenfels adds that if no further provocation is given, and his opponent gradually retreats before the animal's rage has reached its highest point, he does not return to the attack. In other cases he parries the blows directed against him with the skill of a practised fighter; as is also done by the bear, he grasps his opponent by the arm and crunches it, or else throws the man down and rends him with his terrible canine teeth.

The native hunter stalks the gorilla and kills him with his firearm. Savage states that the hunter awaits the approach of his prey with levelled gun, and if he cannot take a sure aim he allows the animal to seize the barrel of the gun, and fires when, as is commonly the case, he tries to carry it to his mouth. If the weapon does not go off, the barrel, which is not strongly made, is crushed between his teeth. When hunters of the Ogōwē are attacked by a gorilla, they will sometimes make a last attempt to defend themselves from the animal's fury with the axe used for felling trees. Buchholz told me that he had seen the skin of a male gorilla

which was injured in the region of the arms, probably in this way. But such a duel generally ends in the death of the hunter.

Pechuël-Lösche talked with two Loango hunters who had killed gorillas. They stated that they had not gone in search of the dreaded animals, but that they chanced to encounter them in the forest. Only if they met a solitary animal did they venture to creep close to it and shoot it, and then they escaped as quickly as possible in order to be safe from the fury of any of its companions which might be lingering near. After several hours they would return in a larger company to carry off their prey. In Loango the flesh of these animals was not eaten; but, according to Ford and Savage, it was cooked by the negroes, in the Gaboon territory, and constituted one of their favourite dainties.

Up to this time Europeans have been rarely successful in killing gorillas. Du Chaillu asserts that he has been one of the luckiest, but this assertion has been disputed by others. Fruitless attempts were made by Winwood Reade, de Compiègne, Buchholz, Lenz, and de Brazza. In the letters quoted above from Koppenfels to Bastian, he mentions that he had already, up to March, 1874, four gorillas. In the number of the *Gartenlaube* shot which we have mentioned above, he describes some of his hunting adventures, and goes into details scarcely adapted for the readers of such a publication. On December 24, 1874, Koppenfels, accompanied by a young Galloa, was on the shores of Lake Eliva, observing a gorilla family, consisting of the

parents and two young ones. The female climbed up an iba, or wild mango tree, and shook down its fruits. The male went to the water's edge to drink, and was then shot by Koppenfels, while the female and her young swiftly escaped. Another time this traveller was in the neighbourhood of Busu, in the Bakalayan country, which is on the Eliva Sanka, and is bounded on the south-east by the mountains of Aschangolo and by extensive primeval forests. It was here that he observed the troop of chimpanzees and gorillas of which we have already spoken, feeding on the kola nuts, of which they are very fond. He shot a large and a small specimen of the chimpanzee; and again in the Aschangolo mountains he shot a male gorilla, 1090 mm. in height. The bullet pierced the animal's heart, and it sprang into the air with outstretched arms, and then crashed down upon its face. It dragged down in its fall a liana of great strength with all its dry and green branches.

Adult male gorillas attain to a height varying between 1500 to 2000 mm., and very rarely exceed that height. The height of the females is about 1500 mm. An ape of this species, examined by Ford, weighed 170 lb. without the viscera. The gorilla shot by Koppenfels in the Aschangolo mountains was more than 400 lbs. in weight. By the people of Mpongwe, Orungu, Kamma, Galloa, and Bakalay the gorilla is called Njina, Njeïna, or Indjina, and by the people of Fan it is called Nguyala. On the Loango coast it is called N'Pungu or M'Pungu.

As I have already remarked, the chimpanzee occupies a much wider area than the gorilla. In West Africa it is found in the latitude of the Portuguese territory, which ranges from Cachêu in the north down to the Coanza in the south. The species is known to exist in certain districts of north and south Central Africa, and its presence is surmised in East Africa, to the south of Abyssinia, in the Djuba territory, and, as the missionary A. Nachtigall asserts, even in the remote district of Sofalla in the south-east of Africa, but I cannot pledge myself to the truth of this fact.

The chimpanzee is also a denizen of forests. They subsist on wild fruits of various kinds, but they will also visit forsaken plantations, and even those which are still under cultivation, and in some cases it seems that they do not reject animal food. Pechuël-Lösche says that on the Loango coast they frequent the mountains and their vicinity. They are found in the district of Luemme as far as the lagoon of Tschissambo, and in those of Kuilu and Banya, as far as the coast.

The chimpanzee either lives in separate families or in small groups of families. In many districts, as, for example, in the forest regions of Central Africa, its habits are even more arboreal than those of the gorilla. Elsewhere, as, for instance, on the south-west coast, it seems to live more upon the ground. The bam-chimpanzee of Niam-Niam inhabits the galleries, as they were called by Piaggia and Schweinfurth; that is, the forest trees growing one above the other in stages, of which the growth is

so dense that it is difficult to get at them. Here the pisang plantain rises from the soil. The powerful stems, thickly overgrown with wild pepper, bear branches from which hang long streams of bearded moss, and also a parasitic growth of that remarkable fern to which Schweinfurth gave the name of elephant's ear. The large tun-shaped structures of the tree-termites are found on the higher branches. Other stems, rotten and decayed, serve as supports for the colossal streamers of *Mucuna urens*, and form bowers overhung with impenetrable festoons, which are as large as houses, in which perpetual darkness reigns.*

When the chimpanzee goes on all fours, he generally supports himself on the backs of his closed fingers rather than on the palm of the hand, and he goes sometimes on the soles of his feet, sometimes on the closed toes. His gait also is weak and vacillating, and he can stand upright on his feet for a still shorter time than the gorilla. At the same time he seeks support for his hands, or clasps them above his head, which is a little thrown back, in order to maintain his balance.

These animals send forth loud cries, which echo plaintively through the great tropical forests. Pechuel-Lösche says that the horrible wails, the furious shrieks and howls, which may be heard morning and evening, and often in the night, make these creatures truly hateful to travellers. "Since they are really accomplished in the art of bringing

* Schweinfurth, *Im Herzen von Afrika*, p. 335: New edition, Leipzig, 1878.

forth these unpleasant sounds, which may be heard at a great distance, and are reproduced by the echoes, it is impossible to estimate the number of those who take part in the dreary noise, but often we seemed to hear more than a hundred. They generally remain upon the ground among the dense underwood and thickets of scitamine, and only climb trees for the sake of obtaining fruit. Their track may be plainly discerned on soft ground: they stop short wherever the *amomum* grows, of which they are very fond, and the red husks of its fruit may be seen scattered all around." The same narrator observes that the mischievous and active sea-cat monkeys, which abound on the Loango, frequently provoke the defenceless chimpanzees by their malicious tricks until the tormented creatures cause the forest to echo with their discordant cries.

These animals wander about, always in search of fresh feeding-grounds. They also construct nests and, as Koppenfels states, the male passes the night below the nest of his family, which is placed on a forked branch. Du Chaillu asserts that the Nschiego-Mbouvé also builds a pent-house. An illustration of this structure, which is only moderately successful, and has undoubtedly been embellished in London, is given by him. Koppenfels believes that the so-called pent-house is only the family nest, under which the male places himself; while Reichenfels thinks it possible that some parasitic growth, perhaps a *Loranthus*, gave rise to the belief that such a pent-house is erected.

When chimpanzees are provoked they strike the

ground with their hands, but they do not, as the gorilla does, beat their breasts with the fist. They generally take to flight at the sight of men, but if driven to extremity, or wounded, they defend themselves with their hands and teeth. The direct conflict with a full-grown chimpanzee demands, in order to obtain the mastery over him, all the strength and presence of mind of a strong and courageous man. I shall always remember the large female animal at Hamburg, which was able to stand up against a powerful man. Great daring was required to control the fury of Mafuca. The Soko also, which Livingstone found in Manyema, to the west of Lake Tanganyika, bravely defended itself, when attacked.

The native hunters shoot chimpanzees with firearms or arrows, and also kill them with javelins. The Niam-Niam tribe go in hunting-parties of twenty or thirty men, to track the bam in the woodland galleries so closely interwoven by the liana, and when they have thrown nets over these, they kill the animals with lances. Their flesh is eaten in different parts of Africa, and their skulls sometimes serve for fetishes. In a Niam-Niam village, by the stream Diamwonu, Schweinfurth saw the skulls of men, chimpanzees, sea-cat monkeys, baboons, antelopes, wild boars, etc., hung on the stump of a tree.

In the Gaboon district, as we have already said, the chimpanzee is called Nschégo, Nschiego, Ndjéko, and the same names serve for the people of Mpongwe, Galloa, Kamma, and Orungu. By the people of Aschira and Malimba the animal is

called Kulu. The natives of Niam-Niam call the chimpanzee Ranja or Mandjaruma. The traders who speak Arabic adopt the name Bam or M'Bam.

The orang-utan is found in the large Asiatic islands of Borneo and Sumatra, more frequently in the former island. It is particularly common a few days' journey to the west of Sungi-Kapajan, on the river Sampiet, in Kotaringin, and in other remote districts on the southern and western coasts.* The Dyaks of Long-Wai told the traveller Bock that the orang was also found further to the north, and at Teweh, as well as in Dusem, to the west of Kutai.† Wallace states that this animal is widely diffused in Borneo, inhabiting many parts of the south-west, south-east, north-east, and north-west coasts, but that it is restricted to the low-lying marshy forests. It seems at first sight inexplicable that this ape should be unknown in Sarawak, while it abounds in Sambas on the west, and in Sadong on the east, but a closer acquaintance with the habits and mode of life of the orang enables us to discern sufficient grounds for the apparent anomaly in the physical conditions of Sarawak. In Sadong, where Wallace observed the orang, he only found it in low marshy districts which were at the same time covered with primeval forests. Many isolated hills rise from these marshes, upon which the Dyaks have settled, and have planted them with fruit trees. These are a

* Duirentuin: Illustrated description of the mammals and birds kept in the Zoological Gardens, Amsterdam. Published in the Dutch language about 1862.

† *Unter den Kannibalen auf Borneo*, etc., p. 31.

great attraction to the orang, which devours the unripe fruits, and then retires again to the marsh. He cannot live on high and dry ground. Thus, for example, he comes in troops into the low parts of the Sadong valley; but on reaching the limits where the ebb and flow of the tide are perceptible, and the ground, though flat, is dry, the orang is no longer found. The lower part of the Sadong valley is indeed marshy, but it is not covered throughout with a growth of tall trees, only for the most part with the Nipa palm; and near the town of Sarawak, the country becomes dry and hilly, interspersed with scattered tracts of primeval forest, and with jungle which was formerly cultivated by the Malays and Dyaks.

The orang is more rare in Sumatra than in Borneo, and in the former island is chiefly found in the north-eastern districts of Siak and Atjin. Rosenberg states that the orang only frequents the flat, marshy forests on the coast between Tapanoli and Singkel, living in thick woods which, on account of their impenetrability, are seldom trodden by the foot of man.

The chimpanzee also frequents the marshy forests which are not too thickly overgrown, while the gorilla prefers such tablelands as are not wholly devoid of water.

Wallace declares that a large area of unbroken and tolerably high primeval forest is necessary for the well-being of the orang. Such forests are like open ground to them, since they can move to and fro in every direction, with the same ease that the

Indians cross the prairie and the Arabs the desert; they go from the top of one tree to the other without ever touching the ground. Those tracts of country which stand high and dry, being more frequented by men, and more often traversed by clearings, and subsequently covered with a low-growing jungle, are unsuitable to the motions characteristic of this animal. He is, in these tracts, more exposed to danger, and more frequently constrained to descend upon the ground. It is also probable that in the district frequented by orangs there is a greater variety of fruits, since the low hills, which stand like islands in the marshy plain, serve as gardens or plantations in which the trees of the hill country flourish.

Wallace observes that it is strange and interesting to watch an orang passing at his ease through the forest. He goes with circumspection along one of the larger branches in a half-upright position, which is rendered necessary by the great length of his arms and the shortness of his legs. He seems always to choose such trees as have their branches interwoven with those which surround them, and when these are within reach he extends his long arms, seizes the boughs in question with both hands, as if to try their strength, then swings himself carefully on to the next branch, and goes on as before. The woodcut we subjoin, taken from a photograph by Hermes, in the Berlin Aquarium, may help to explain this ape's mode of climbing* (Fig. 63).

* This illustration confirms the remark already made, that the posterior of this ape somewhat resembles the rump of a bird in structure.

As Wallace further remarks, the orang never leaps or springs, seems to be in no haste, and yet

Fig. 63.—Climbing orang-utan, seen from behind.

makes his way through the forest almost as fast as a man can run on the ground below. His long,

powerful arms are of the greatest use, enabling him to climb the highest trees with ease, to seize the fruits and young leaves from branches which would not bear his weight, and to collect the young leaves and boughs with which he forms his nest. This structure, which serves for his nocturnal refuge, is generally placed on some low, small tree, which stands only from twenty to fifty feet from the ground, probably because such a situation is warmer and less exposed to the wind. It is said that the orang makes a fresh layer for himself every night, but Wallace thinks this improbable, since, in this case, the deserted nest would be more frequently found; this author saw some such nests in the neighbourhood of the coal mines of Simunjon, but since many orangs must have been there every day, in the course of a year their forsaken layers would be very numerous. The Dyaks say that when the orang is wet he covers himself with pandanus-leaves or large ferns, and this has perhaps led to the belief that he builds himself a hut in the trees. The orang only leaves his layer when the sun is tolerably high, and the dew has dried off the leaves. He feeds throughout the middle of the day, but seldom returns two days running to the same tree.

These animals seem to be much afraid of man. Wallace never saw two full-grown specimens together, but both male and female are often accompanied by their half-grown young, and three or four young animals may be seen going about together without their parents. The orang generally lives on fruit, but occasionally also on leaves, buds, and young

shoots, as, for instance, on the bamboo. They are particularly fond of the durian, of which the smell is so offensive and the taste so good (*Durio zibethinus*). They destroy much more than they consume, and leave many fragments below the trees on which they have been feeding. I do not know whether orangs, as well as gorillas and chimpanzees, display any taste for carnivorous food. Huxley, who has collected much information about anthropoids which is not accessible to others, states that it is not known whether the orang destroys living animals.

The same naturalist terms the orang's gait on all fours laborious and unsteady. If chased, he runs faster than a man, but is soon overtaken. The very long arms, which are only slightly bent in running, raise the body in a remarkable way, so that the orang almost assumes the position of a very old man, bowed by age, who supports himself with a stick. When walking, this ape places the closed fingers, or rarely the open palm, of the hands upon the ground. The toes of the feet are also curved inwards, so that the outer edge of the foot is turned downwards. More rarely the toes are completely closed, or the whole of the sole of the foot serves as the support. The use of the outer edge of the foot in walking, as Huxley justly observes, is such as to bring the heel more upon the ground, while the curved toes partly touch the ground with the upper surface of their first phalanges, and the surface of the outermost toes of each foot rest altogether on the ground.

Wallace says that the orang seldom comes down upon the ground, and indeed only when he is driven by hunger to seek for the juicy young shoots on the banks of rivers, or when in very dry weather he goes down to the water, of which he generally finds a sufficient supply in the hollow of leaves. This traveller on only one occasion saw two half-grown orangs on the ground in a dry hole at the foot of the Simunjon hills. They were at play together, standing upright and alternately seizing each other by the arms. This observer also considers that the orang is only able to stand upright when he has some support for his hands, or when he is attacked.

Like other anthropoids in a state of nature, when the orang drinks, he crouches down to the water's edge and sucks in the liquid with his lips. Occasionally, also, he draws water in the palm of his hand, and gulps or licks it off; at any rate, he does this when in captivity. In an old number of the *Penny Magazine* there is a woodcut of an orang which is very true to nature, in which he is represented as squatting down by the water, washing his hands, and this is really his habit.

Müller and Schlegel * state that the adult males live alone except during the pairing season. Aged females and young males are often seen together in parties of two or three, and the mothers generally keep their young with them. Pregnant females generally live apart, and continue to do so for a

* *Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche Bezittingen:* Leiden, 1840–45.

good while after the birth has taken place. The young, which are slow in coming to maturity, live long under the protection of their mother, who, when she is climbing, carries her little ones in her bosom, while they cling to her long, shaggy hair. It is not yet ascertained at what age the orang becomes capable of propagating his species, nor how long the females continue to bring forth young.

This animal is slow, phlegmatic, and has none of the agility of the chimpanzee, nor even of the gibbon. Hunger alone seems to prompt his actions, and when appetite is appeased the animal relapses into repose. In sitting, the back is so bent, and the head so depressed, that the orang's eyes are directed downwards to the earth. Sometimes he holds on with his hands to the higher branches, but generally his arms fall idly by his sides. In such positions the orang will remain for hours in his place, almost motionless, and only occasionally sending forth a note of his deep, gruff voice. By day he is accustomed to go from one tree-top to another, and he only comes down to the ground at night. When anything occurs to scare him, he conceals himself in the underwood. When not hunted, he remains long in one place, and indeed, for several days together on the same tree. He seldom passes the night on a high tree, which he finds too cold and windy, and when night approaches he scrambles down to the lower and more sheltered parts, or to the top of some low, leafy tree, such as the Nibong palm, the pandanus, or the parasitic orchids which are characteristic of the primeval forests of Borneo.

He constructs his nest out of small branches and leaves, laid crosswise, and lined with fronds, or with the leaves of orchids, *Pandanus fascicularis*, *Nipa fruticans*, etc. The nests observed by Müller were some of them still quite fresh, placed at a height of from ten to fifteen feet from the ground, and were from two to three feet in diameter. Some of them had a lining of pandanus leaves several inches thick. In others the branches intertwined for a foundation were united in a common centre, forming a uniform surface.

The Dyaks say that the orang generally leaves his lair about nine a.m., and repairs to it again about five p.m., or a little later, when it is growing dusk. He sometimes lies on his back, or, by way of change, on his side, drawing his legs up to his body, and supporting his head on his hand. When the night is cold, windy, or rainy, he covers his body, and especially his head, with pandanus or nipa leaves, or with fronds of fern.

Although the orang lives in the daytime on the branches of large trees, he seldom crouches on a thick bough, as other apes, and especially the gibbon, are in the habit of doing. He keeps rather to the slender, leafy branches, so that he really reaches the tree-top. He has not the sessor-callosities found on other apes, including the gibbon, and the hips are not so wide and prominent as in those species provided with callosities.

The orang is a slow and deliberate climber. He is particularly careful about his feet, and seems much more sensitive to any injury to them than is

the case with other apes. In climbing he alternately uses one hand and one foot, or else, as soon as he has taken a firm hold with his hands, he draws up both feet together. In his passage from one tree to another, he always looks out for a place where two branches come close together, or intertwine. Even when hotly pursued, he displays wonderful caution, trying the strength of the branches, and pressing them down by the weight of his body, so as to make a bridge from tree to tree. On this point the accounts of the Dutch naturalists essentially agree with those of Wallace.

There is an eager search for these apes in their native place. Bock states the Malays of Samarinda, in the south-east of Borneo, capture them near the small brooks and streams which flow into the Mahakkam close to that town. These animals come down to the river-bank in the early morning and return in the course of the day to the thicket. When the natives take an orang alive, they sell him for three dollars to the Chinese, who at first feed the animal on fruit, and afterwards on rice, but are never able to keep him alive for any time in captivity.*

Although, in the ordinary course of his existence, the orang shows himself to be melancholy, slothful, and indifferent, yet in moments of danger he becomes angry and able to defend himself. When pursued, he is said to pelt his aggressors with broken branches, and the thick, thorny outer husks of the durian fruit. This is the more probable since the Tscheladas

* *Unter den Kannibalen auf Borneo*, p. 31.

(*Cynocephalus Gelada*), the Hamadryas (*Cynocephalus Hamadryas*), and other baboons are in the habit of hurling branches, stones, and hardened clods of earth with great adroitness at those who attack them. In a hand-to-hand fight, the orang seizes the arm of his opponent, biting and scratching it whenever he can get at it. Wallace says that no wild animal ventures to fight with these powerful creatures, and that they can even obtain the mastery over crocodiles and gigantic snakes.

The name orang-utan is derived from the words orang, man, and utan (belonging to woods), and is therefore merely wood-man. It is an error to write orang-*utang*, which, according to Von Martens, signifies an *indebted* man.* The Malay name, meias, is often used, and they are distinguished as meias-pappan or zino, meias-kassu, and meias-rambi. According to Rosenberg, the orang is called mawas in Sumatra, and Bock says that the Dyaks of Dusun call it këu.

The gibbon in all its movements, and especially in those of its long arms, has a very singular appearance. In the second chapter of this work I have already described the geographical distribution and grouping of the species of these remarkable animals. Although they occasionally come down upon the ground, they are for the most part arboreal in their habits. They prefer the tropical forests of high and even of mountainous districts to any others. Many find shelter in the bamboo thickets, especially

* *Die Preussiche Expedition nach Ostasien. Zoologische Abtheilung*, vol. i. p. 249: Berlin, 1876.

in those formed by the gigantic stems of *Bambusa macroculmis* and *Bambusa gigantea.*

The siamang, properly Si-Amang, since Rosenberg asserts that the first syllable is merely the article, lives gregariously in Sumatra, and possibly in Malacca. Martens saw one of these animals in Sumatra, swinging himself from tree to tree, right across the path, about fifty feet in front of him. Diard states that a powerful old male acts as leader to each troop. They raise a fearful clamour at sunrise, and keep quiet during the day, always on the watch, and scampering off at the slightest noise. They find it easy to get away on trees, but, according to some accounts, when surprised upon the ground, they show no agility, and are readily captured. Rosenberg says that in Sumatra the siamang and unko inhabit mountainous forests 3000 ft. above the sea, keeping to the trees which grow on the mountain-side, and rarely descending to the ground. At the slightest sign of danger they hasten down the mountain with speed which rivals the flight of birds, in order in a few moments to disappear in the dark ravines. In the forests which partly enclose Tobing, as well as on the mountains of Barissa, the siamang is not rare. Bock says that in the recesses of the Sumatran forests, this animal subsists chiefly on the leaves of a plant called *Daun simantung*. This ape makes a horrible roaring noise.* When a young one is wounded, its mother turns in a threatening manner towards the aggressor, yet without being able to do him any

* *Unter der Kannibalen auf Borneo*, p. 327.

serious injury. The mothers seem to act with great tenderness towards their young, taking them down to the water to wash and dry them, etc. Diard affirms that before they are able to run alone the young animals are always carried by the parent of the same sex, the male by the father, the female by the mother. The siamang must fall an easy prey to tigers and panthers (*Felis macroscelis*). The species is considered by the natives to be slothful and unintelligent; and Bock adds that, although the Malays are skilled in the care of animals, they are unable to keep these stupid and slothful apes alive in captivity for any length of time.*

Harlan states that the hulock is found on the Garrau mountains, near Gulpara, in Assam. These apes prefer the adjoining hilly ground to the mountains themselves, which are several hundred feet higher, and exposed to the winds. Their favourite food is a fruit called propul, which is very abundant in this district. A traveller named Owen encountered troops of these animals, from 100 to 150 together, near the Naga and the Abors in the wooded hills to the east of Assam. The noise they made was deafening. On one occasion, when Owen crossed their path, he was threatened by them, and pursued with angry gestures and piercing howls. They had also attacked a native of the district. Snakes of considerable size (*Python reticulatus*) were torn to pieces by them.

The wauwau, or, as Martens calls it, the uwa-uwa,

* Sir Stamford Raffles saw a perfectly white specimen of this species (*Transactions of the Linnæan Society*, xiii. 241).

appears to live more commonly in pairs than in troops. We learn from Duvaucel that these animals move through the trees with great swiftness, grasping the slenderest and most flexible branches. They swing two or three times to and fro, and then spring with outstretched arms so that the flat surface of the body resists the air like a parachute, and in this way they can pass through spaces of forty feet, and go on for hours without fatigue.

Gibbons are generally more capable than other anthropoids of walking upright. Some species, such as the lar, the white-handed, and the slender gibbon, display special dexterity and endurance in maintaining this position. They press the flat soles of their feet upon the ground, turn out their knees and toes, hold their bodies fairly erect, draw the shoulders together, and place their half-bent arms by their sides, with the slender hands hanging slackly down. Others walk with their raised arms crossed above the head. When a gibbon is walking on perfectly flat ground, he sways his arms to and fro like balancing poles. On irregular ground they seize any projection in the way with their outstretched arms, and, holding on to it, swing the body strongly forwards. In this way they make better progress over wide tracks of country, since every such effort enables them to pass more readily over difficult ground. When in great haste, they go upon all fours without closing either fingers or toes. In repose, these animals take a sitting position upon their posteriors, cross their long arms and stare at whatever is before them with an air

of indifference. When seated on the branches of trees, they lay hold of the higher branches above them for the sake of security (Fig. 14). In this position some gibbons (*Hylobates lar*, *Hulock*, *Albimanus*) have recently been photographed in the Zoological Gardens, London. Although they are for the most part content with a vegetable diet, gibbons sometimes eat animal food, such as lizards; and Bennet saw a siamang seize and devour one of these animals whole. I do not at this moment remember Huxley's authority for the statement that gibbons, when they drink, dip the hand in water and lick it off, but I have myself seen this done by a captive animal. They sleep in a sitting position without building nests: like other anthropoids, they digest their food quickly.

In the case of gibbons, as of anthropoids generally, the length of the period of gestation is still a matter of uncertainty. The young are of slow development, and are not fully mature before their fourteenth or fifteenth year. Neither is the duration of their lives accurately known, since observations made on captive specimens only lead to vague conclusions. If we observe the processes of osseous development in the skeletons of aged specimens of gorillas in order to make an approximate estimate, we may infer that the duration of the life of anthropoids, at any rate in their larger forms, hardly falls short of the average length of human life. But up to this time the question remains undecided.

These creatures do not appear to be free from morbid conditions in the wild life which is in con-

formity with their nature. In addition to the injuries to the hide and skeleton which may often be observed, and which have been caused by the weapons of man, or by the teeth and claws of their own kind, there are often traces, especially on the skulls of chimpanzees, of the decay of teeth and maxillary necrosis, as well as of curvatures, excrescences, and united fractures of other parts of the bony structure.

This brief description is enough to show that anthropoids in their free life develop an intelligence which sets them high above the other mammals. They do not, however, display the keenness of scent and quickness of sight which distinguish some animals of a lower order, such as canine beasts of prey and ruminants manifest in many different ways. The structure of their nests is rude in comparison with that of some other mammals—as, for example, of rodents. But we must not forget that several of the lower races of men, such as the degraded Bedja, the Obongo, the Fuegians, many aborigines of the Brazilian forests, and the Australian blacks, scarcely rise above the inartificial structure of an anthropoid's nest in the construction of their huts.

CHAPTER VI.

LIFE IN CAPTIVITY.

The accounts given by the earliest observers of gorillas would lead us to expect that the attempt to tame even young apes of this species must be fruitless. Du Chaillu tells us that he obtained a young male gorilla, a creature of from two to three years old, which was quite as furious and unmanageable as any adult specimen could have been. The negroes of the district between the Rembo and Cape Santa Catharina had surprised the mother and her young one in the forest, and after killing the former, they succeeded, with great difficulty, in capturing the latter by throwing a cloth over his head. By means of a wooden slave-fork, fixed upon its neck, the animal was transported to the village in which Du Chaillu was staying at the time. Young as he was, the gorilla displayed extraordinary strength, and after he had been successfully fastened into his cage, he contrived to attack his new master again, tearing his trousers, and then retreating sullenly into a corner. He would only

eat the wild berries and fruits collected for him in the forest, and also the soft parts of pine-apple leaves. He escaped from his cage, and was only recaptured, after many fruitless endeavours, by throwing a net over him. The traveller adds that he had never seen so furious a creature as this gorilla. He flew at every one who came near him, bit the bamboo lattice-work of his cage, and showed, on every possible occasion, that he was of a thoroughly malicious and unkindly nature. He broke loose a second time, and was again captured, and at the end of ten days he died suddenly.

Somewhat later Du Chaillu obtained a young female gorilla, which clung affectionately to its mother's dead body, so that all the spectators were affected by its grief. The creature was too young to be fed on anything but milk, and since this was unattainable, it died three days after its capture.

Reade, Lenz, and Buchholz were more fortunate in their experience with the gorillas captured by them, and Lenz wrote to me as follows about one of these animals:—"On my return to the Gaboon from a journey to Okanda, I was attacked by a somewhat serious fever which hung about me for a long while. A living gorilla, which was brought to the German factory on the Gaboon, was some compensation to me for this involuntary idleness. The creature came from Kamma (Fernand Vaz), the place from which Du Chaillu also obtained his specimens, and was captured out of a troop of eight animals. A small dog, which had been somewhat injured by an old gorilla, afterwards killed, pre-

vented the young one from escaping until a negro came up, seized it by the neck, and got another man to bind its hands. In this way the gorilla was conveyed to the basket-factory of the house, and there, as is unfortunately done in most cases, the two large canine teeth were filed off for fear of his using them to bite his captors.

"This gorilla is a young, male specimen, probably two years old, and has reconciled himself to captivity and to intercourse with men with no great difficulty. A long, slender iron chain is fastened round his neck, which gives him plenty of room to move about; but for the greater part of the day he sits in a cask, and makes himself very comfortable in the straw. He is very susceptible to cold, wind, and rain, and a thick sail-cloth is wrapped round the cask at night. He generally adopts a squatting position, with his arms folded across his breast, and he is always observant of surrounding objects. He always seats himself so as to have nothing at his back, but to keep his enemies before him. When asleep, he stretches himself at full length on his back or side, using one hand as a kind of pillow; and he never sleeps like other apes, in a squatting position. He goes upon all-fours with the soles of his hindhands on the ground, while the forehands are closed, so that he goes upon the knuckles, and he has the lateral gait characteristic of the species. At this moment he suffers terribly from the so-called dissous or sand-fly; both his forehands are full of blisters, which contain the eggs of this annoying little insect.

"In any attempt to transport the gorilla, the question of food is necessarily the most important. We have already offered him rice, bread, milk, etc., such things as may be obtained on board ship, as well as in Europe, but with indifferent success. He has occasionally eaten some bread, and has taken ship's biscuit more readily, and once he ate some rice, but for the most part he does not touch it. His favourite food is a red fruit, very common here, of which he eats the inner kernel; he is likewise fond of bananas and oranges, and above all, of sugar-cane, which he takes from my hand with evident pleasure, and chews. He will also take a glass of water from my hand, carry it steadily to his mouth, and drink it up. Only on rare occasions, when he was much excited, I have heard him utter a growling noise; generally he is quite dumb." This animal died on the voyage to Europe, and its body, preserved in rum by Pansch and Bolau, was used by me in some of the researches of which I have given an account.

Falkenstein gives an attractive description of the gorilla represented in Figs. 3, 4, during the first months of his captivity: "When this animal reached the station (Chinxoxo, in Loango) it was our first care to procure all the forest fruits within reach, as well as a she-goat, in order to restore the young anthropoid's failing strength. It can easily be supposed that we watched his attempts to eat with great interest, and were very much relieved when he not only readily drank milk, but ate various fruits with evident increase of appetite, and es-

pecially those of *Anona senegalensis,* which are of about the size of a walnut, with a rough husk, and grow in the savannahs. In spite of this, however, he remained for a long while so weak that he would fall asleep while eating, and he passed great part of the day crouching asleep in a corner. He gradually became accustomed to cultivated fruits, such as bananas, guavas, oranges, and mangoes, and as he became stronger, and was more often present at our meals, he began to demand for himself whatever he saw us eating. Since he was thus gradually accustomed to eat all kinds of food, the likelihood of transporting him successfully to Europe was increased."

This is perhaps the only way in which other and possibly older specimens can be rendered fit to endure the passage to Europe. Every attempt to embark them immediately after their capture, without previously weaning them from their old modes of life, and adapting them slowly and systematically to their altered conditions, has invariably resulted, sooner or later, in sickness and death. Falkenstein also recommends, relying on the experience he has had of apes in a state of nature, that this species should be supplied with some form of animal food. He gives this further account of the captive gorilla:—

"In the course of a few weeks he became so accustomed to his surroundings, and to the people whom he knew, that he was allowed to run about at liberty, without fear that he would make any attempt to escape. He was never chained, nor con-

fined to a cage, and was watched only in the way that little children are watched when they are at play. He was so conscious of his own helplessness that he clung to human companionship, and displayed in this manner a wonderful dependence and trustfulness. He showed no trace of mischievous, malicious, or savage qualities, but was sometimes self-willed. He expressed the ideas which occurred to him by different sounds, one of which was the characteristic tone of importunate petition, while others expressed fright or horror, and in rare instances a sullen and defiant growl might be heard.

"In his moods of exuberant satisfaction and simple pleasure, he might be seen to rub his breast with both fists, while raising himself on his hind legs. Moreover, he often expressed his feelings after quite a human fashion, by clapping his hands together, an action which no one had taught him; and he executed such wild dances, sometimes overbalancing himself, reeling to and fro, and whirling round, that we were often disposed to think that he must be drunk. Yet he was only drunk with pleasure, and this impelled him to display his strength in the wildest gambols.

"His dexterity in eating was particularly remarkable. If any of the other apes chanced to enter his chamber nothing was safe from them; they snatched greedily at everything, only to throw it away with a certain aversion, or carelessly to let it drop. The gorilla behaved quite differently: he took up every cup or glass with instinctive care,

clasped the vessel with both hands, and set it down again so softly and carefully that I cannot remember his breaking a single article of our household goods. Yet we never taught the creature the use of our vessels and other manufactured articles, since we wished to bring him to Europe, as far as possible in a state of nature. His behaviour at meal-times was quiet and mannerly; he only took as much as he could hold with his thumb, fore, and middle finger, and looked on with indifference when any of the different forms of food heaped up before him were taken away. If, however, nothing was given him, he growled impatiently, looked narrowly at all the dishes from his place at table, and accompanied every plate carried off by the negro boys with an angry snarl or a short, resentful cough, and sometimes he sought to seize the arm of the passer-by in order to express his displeasure more plainly by a bite or a blow. In another minute he would play with the negroes as with his fellows, and this distinguishes him altogether from other apes, and especially from baboons, who appear to feel an instinctive hatred against many of the black race, and take a peculiar pleasure in displaying their animosity against them.

"He drank by suction, stooping over the vessel without even putting his hands into it or upsetting it, and in the case of smaller vessels, he carried them to his mouth. He was a skilful climber, but sometimes his high spirits made him careless, and he once fell to the ground from a tree, which was fortunately not very high. His cleanliness was

remarkable, for if by accident he touched a spider's web, or rubbish of any kind, he sought to brush it off with absurd horror, or held out his hands to have it done for him. There was no offensive smell about him. It was his favourite amusement to play and paddle about in the water, nor did the fact that he had just taken a bath prevent him from amusing himself by rolling in the sand with other apes immediately afterwards. His good-humour and shyness, or rather roguishness, deserves special mention as his strongest characteristic. When he was chastised, as it was necessary to do at first, he never resented the punishment, but came up with a beseeching air, clinging to my feet, and looking up with an expressive air which disarmed all displeasure. When he was anxious to obtain anything, no child could have expressed its wishes in a more urgent and caressing manner. If in spite of this he did not obtain what he wanted, he had recourse to cunning, and looked anxiously about to see if he was watched. It was just in these cases, when he obstinately pursued a fixed idea, that it was impossible not to recognize a deliberate plan and careful calculation. If, for example, he was not allowed to leave the room, or, again, was not allowed to come in, he would, after several attempts to get his own way had been baffled, apparently submit to his fate and lie down near the door in question with assumed indifference. But he soon raised his head in order to ascertain whether fortune was on his side, edging himself gradually nearer and nearer, and then, looking carefully round, he twisted himself about until

he reached the threshold; then he got up, peered cautiously round, and with one bound galloped off, so quickly that it was difficult to follow him.

"He pursued his object with equal pertinacity when he felt a desire for the sugar or fruit which was kept in a cupboard in the eating-room; he would suddenly leave off playing and go in an opposite direction, only altering his course when he believed that he was no longer observed. He then went straight to the room and cupboard, opened it, and made a quick and dexterous snatch at the sugar-box or fruit-basket, sometimes closing the cupboard doors behind him before beginning to enjoy his plunder, or, if he was discovered, he would escape with it, and his whole behaviour made it clear that he was conscious of transgressing into forbidden paths. He took a special, and what might be called a childish, pleasure in making a noise by beating on hollow articles, and he seldom omitted an opportunity of drumming on casks, dishes, or tin trays, whenever he passed by them—a noisy amusement to which he was much addicted during our homeward voyage on board the steam-vessel, in which he was at liberty to roam about. He very much disliked strange noises. Thunder, the rain falling on the skylight, and especially the long-drawn note of a pipe or trumpet threw him into such agitation as to cause a sudden affection of the digestive organs, and it became expedient to keep him at a distance. When he was slightly indisposed, we made use of this kind of music with results as successful as if we had administered purgative medicine."

My personal observations enable me to add but little to this excellent and exhaustive account. It is well known that this ape throve in the Berlin Aquarium. His skin, especially on the extremities, was at first covered with dry, cracked patches, which the late veterinary surgeon Gerlach believed to be due to mange; but these gradually disappeared, and as they scaled off the skin became smooth and of a dark black colour, and there was a fresh growth of hair. The creature generally slept in the bed of his keeper Viereck, covered himself up in an orderly manner, and ate at the man's table of plain but nourishing food, cooked by the keeper's wife. He sometimes ate fruit, and bananas were occasionally provided for him. When taking his meals, drinking, etc., I saw that he always behaved with good manners. He often moved freely about in an office-room of the Aquarium, and he was as obedient to the Director as to his keeper. He was generally good-tempered, fond of play, but rather mischievous, and he would snatch roughly, and occasionally try the sharpness of his teeth. Sometimes he tried to seize from visitors things which attracted his curiosity, such as the trimmings of ladies' bonnets, lace falls, and the like. But on the whole he behaved with propriety, playfulness, and good temper, and there was much which resembled man in his look and bearing.

Early in 1876, before leaving Africa, this ape suffered from malaria, and he subsequently suffered from other complaints, from which he recovered. He died in November, 1877, of a galloping con-

sumption.* The gorilla now living in the Berlin Aquarium is also very playful and affectionate.

The chimpanzees which have up to this time been observed in captivity, have been, while in good health, lively and amusing animals, and generally good-tempered. Buffon in 1740 possessed a specimen about two years of age, and this ape always walked upright, even when he carried heavy loads. It is known that other apes can also be trained to adopt this posture. Buffon's chimpanzee had a serious and melancholy expression, moved slowly, was gentle and patient, and obedient to a word or sign. He offered people his arm, walked with them in an orderly manner, sat down to table like a man, opened his napkin and wiped his lips with it, made use of his spoon and fork, poured out wine and clinked glasses, fetched a cup and saucer and put in sugar, poured out tea, let it get cold before drinking it; but, while doing all this, he did not seem happy. He ate all the ordinary food of men, but preferred fruit, and he was not so fond of wine as of milk, tea, and sweet liqueurs. He was friendly with every one, coming close to them, and taking pleasure in their caresses. He took such a fancy to one lady, that when other people approached her he seized a stick and began to flourish it about, until Buffon intimated his displeasure at such behaviour.

Dr. Traill, of Liverpool, obtained a female chimpanzee which likewise came from the Gaboon, and which, as soon as she came on board, reached out her

* G. Broesike, *Sitzungtbericht der Gesellschaft naturforschender Freunde zu Berlin*: December 18, 1877.

hand to some of the sailors, and remained on good terms with the whole crew, including the cabin-boy. When the sailors were at meals the ape regularly appeared, and begged for her portion. When angry she made a baying noise like a dog, and on another occasion she wailed like a spoiled child, scratching herself vehemently. She was lively and cheerful in warm regions, but the nearer the vessel approached to northern latitudes the more inert she became, and was glad to wrap herself in a warm coverlet. She seemed uneasy in an upright position, and when she assumed it she rested her hands on her thighs. Her hands were very strong, and she could hold on to a cord and swing for a long while without interruption. She gradually acquired a taste for wine, and once stole a bottle and uncorked it with her teeth. She was fond of coffee and sweetmeats, ate with a spoon, drank from a glass, and took pleasure in imitating the behaviour of men. She was attracted by shining metals, pleased with articles of clothing, and often put on a hat. She was unclean, and of a timid disposition.

According to the account of Captain Grandpré, a female chimpanzee on board his vessel would heat the oven, taking care that no coals fell out, and carefully watching until it was of the right heat, of which she would inform the baker. She fulfilled all the duties of a sailor, such as drawing up the anchor, furling and making fast the sails. She patiently endured maltreatment by a brutal mate, stretching out her hands imploringly to ward off his blows. But after this she refused all food, and died in five days of grief and hunger.

A chimpanzee in Brosse's possession was sick, and twice blooded. When he again fell ill, he held out his arm as if to demand another venesection.

In reading these accounts, which have gone the round of various old-fashioned books on natural history, the question arises what we are or are not to believe, for many particulars appear to be exaggerated. Dr. Hermes, the director of the Berlin Aquarium, disputes the assertion made by others that the female chimpanzee, Molly, which was kept for a long while in that establishment, poured out wine for herself at an evening party, and clinked glasses with a neighbour.*

There is, however, an account given by Broderip of a male chimpanzee, which was brought from the Gambia, and placed in the London Zoological Gardens in 1835, which appears to be simple and faithful. The creature, clothed in a little jacket, nestled for the most part in the lap of an old female keeper. When he had nothing else to do, he played with his toes, just as a child does under like circumstances. He took Broderip's hand without fear, and touched the ring on one of his fingers with his teeth, but without bending it. He tried all artificial substances with his teeth. He held fast to his keeper's gown when she proposed to leave him, and he played with Broderip like a child. He displayed great terror when an anaconda was brought into the room in a basket, and did not dare to take an apple from off the closed lid of the basket; but as soon as

* *Verhandlungen der berliner Anthropologischen Gesellschaft,* March 18, 1876, p. 93.

the snake and its basket were removed, he ate the apple and became cheerful again. He willingly placed himself in a swing, and held on to the cords with both hands. He generally slept in a sitting position, leaning forwards with folded arms, or sometimes resting his face on his hands. But he would also sleep upon his belly, with his feet drawn up, and his head on his arms.

A male chimpanzee, which was kept in the Berlin Aquarium in 1876, was remarkable for his excessive liveliness. He had contracted a friendship with a fellow-captive, a young female orang, and their intimacy was confirmed by their games together, accompanied by many tender embraces. The small orang, a good-tempered, phlegmatic creature, allowed the chimpanzee to do what he pleased with her, and the former betrayed remarkable intelligence. In consequence of a general repair of his cage, Dr. Hermes, the director of the institution, to whom we owe this account, was obliged to keep the chimpanzee in his office, in company with himself and other officials. The chimpanzee soon accustomed himself to his new surroundings, and was on particularly friendly terms with Dr. Hermes' two-year-old boy. When the child entered the room, the chimpanzee ran to meet him, embraced and kissed him, seized his hand and drew him to the sofa, that they might play together. The child was often rough with his playfellow, pulling him by the mouth, pinching his ears, or lying on him, yet the chimpanzee was never known to lose his temper. He behaved very differently to boys between six and ten years old.

When a number of schoolboys visited the office, he ran towards them, went from one to the other, shook one of them, bit the leg of another, seized the jacket of a third with the right hand, jumped up, and with the left gave him a sound box on the ear; in short, he played the wildest pranks. It seemed as if he were infected with the joyous excitement of youth, which induced him to riot with the troop of schoolboys.

One day when Hermes gave his nine-year-old son a slight tap on the head, on account of some miscalculation in his arithmetic, the chimpanzee, who was also sitting at the table, gave the boy a smart box on the ear. If Hermes pointed out to him that some one was staring or mocking at him, and said, "Do not put up with it," the creature cried, "Oh! oh!" and rushed at the person in question in order to strike or bite him, or express his displeasure in some other way. As he made distinctions in the age of human beings, so also with animals. He was gentle and considerate in his behaviour to young dogs and apes, while with older animals he was as boisterous as he was with the schoolboys. When he saw that Hermes was writing, he often seized a pen, dipped it in the inkstand, and scrawled upon the paper. He displayed a special talent for cleaning the window-panes of the aquarium. It was amusing to see him squeezing up the cloth, moistening the pane with his lips, and then rubbing it hard, passing quickly from one place to another.

Mafuca was a remarkable creature, not only in her external habits, but in her disposition. At one

moment she would sit still with a brooding air, only occasionally darting a mischievous, flashing glance at the spectators; at another she took pleasure in feats of strength, or she roamed to and fro in her spacious enclosure like an angry beast of prey. She would insert the index finger of her right hand in the opening of a vessel which weighed thirty pounds, climb up the pole with it, and let it fall with a crash and clatter from a height of six feet. This ape would sometimes rattle the bars of her cage with a violence which made the spectators uneasy. She was fond of playing with old hats, which she set upon her head, and if the top was quite torn off, she drew it down upon her neck. Mafuca clawed at people who entered the vestibule of her cage and tried to tear their clothes. She hardly obeyed any one except Schöpf, the director of the Dresden Zoological Gardens, and when in a good humour she would sit on his knee and put her muscular arms round his neck with a caressing gesture. In spite of this, Schöpf was never secure from Mafuca's roguish tricks, since her good-humour was of short duration. She was rather fond of the keeper, but not always obedient to him, and the whip was often in request, even at feeding-times. Mafuca was able to use a spoon, although somewhat awkwardly; and she could pour from larger vessels into smaller ones without spilling the liquor. She took tea and cocoa in the morning and evening, and a mixed diet betweenwhiles, such as fruit, sweetmeats, red wine and water, and sugar.

Mafuca, for a while, was pleased with the com-

panionship of a pretty sea-cat monkey, but she teased the creature so much that a special refuge was set apart for it, into which she could not enter. She was so scared and terrified by a heavy thunderstorm that she seized her sleeping playfellow by the tail and dashed it to the ground. She chased the mice which ran about her cage with deadly fury. She was much afraid of snakes, which is not usually the case with chimpanzees. If she was left alone for any time she tried to open the lock of her cage without having the key, and she once succeeded in doing so. On that occasion she stole the key, which was hanging on the wall, hid it in her axilla, and crept quietly back to the cage. With the key she easily opened the lock, and she also knew how to use a gimlet. She would draw off her keeper's boots, scramble up to some place out of reach with them, and throw them at his head when he asked for them. She could wring out wet cloths, and blow her nose with a handkerchief. When her illness began, she became apathetic, and looked about with a vacant, unobservant stare. Just before her death, from consumption, she put her arms round Schöpf's neck when he came to visit her, looked at him placidly, kissed him three times, stretched out her hand to him, and died.* The last moments of anthropoids have their tragic side!

We owe to Wallace an interesting account of young orangs in a state of captivity. This observer shot, near Simunjon, in Borneo, a large female ape

* See also Nissle, *Die Zeitschrift für Ethnologie*, pp. 56, 57: 1876.

of this species, which had a young one about a foot long. As Wallace carried this creature home, it took such a firm hold of his beard that he had much difficulty in getting free, for the unequal phalanges of the fingers in these animals are hook-shaped. At that time the creature had not a single tooth, but the two lower front teeth were cut a few days later. Unluckily, there was no milk, nor any female animal to give suck to the little ape. Wallace was obliged to give it rice-water from a bottle, with a quill inserted in the cork, from which, after some attempts, it learned to suck very well. Sugar and cocoa-milk were added, to make the pap more nourishing. When Wallace put his finger in the creature's mouth, it sucked at it vigorously, then pushed it angrily away and began to scream, as a child does in like circumstances. When it was fondled and caressed, it was quiet and content, but began to scream again as soon as it was laid down; and for the first two nights it was very noisy and restless.

Wallace arranged a little box for the creature's cradle, with a soft mat which was changed and washed every day. The little ape itself liked to be washed. As soon as it was dirty it began to scream, and never stopped until carried to the spring by its master, when it became quiet at once, although it struggled when first touched by the cold water, and made absurd grimaces when water was poured over its head. It was extremely fond of being dried and rubbed, and appeared to be perfectly happy when Wallace brushed its hair, lying quite still with extended arms and legs while the long hair on its

back and arms was brushed out. At first it clung helplessly by all-fours to whatever it could get hold of, and Wallace had to be always on the watch to save his beard. When restless, it worked its hands above in the air, in search of something to hold, and if it got hold of a stick or piece of cloth with two or three of its hands, it was perfectly happy. In default of anything else, it nursed its own foot, and after a while it often folded its arms, and seized with each hand the long hair which grew below the opposite shoulder. The strength of the creature's gripe soon diminished, however, and Wallace had to invent expedients for giving it exercise and strengthening its limbs. With this object he made a short ladder of three or four rounds, to which he suspended the young orang for a quarter of an hour at a time. At first it was pleased, but finding itself unable to assume a comfortable position when holding on by all four hands, it let go with one after another and at last fell to the ground. Often, when only hanging by two hands, it let go with one, in order to cross it over the opposite shoulder, and get hold of its own hair, and on finding this much more agreeable than the piece of wood, it let go with the other, and so fell to the ground, where it lay on its back with folded arms, quite content and apparently none the worse for its numerous tumbles.

When Wallace saw how fond the creature was of hair, he endeavoured to construct an artificial mother by stitching together a piece of buffalo hide which he suspended about a foot from the ground. At first this seemed quite successful, since the small

orang could cling round it and always find something hairy to which it held fast with great persistency. Wallace now hoped that he had made the little orphan happy, and so it was for a while, until it remembered its lost mother and tried to suck. It raised itself so as to be quite close to the hide, and hunted about for promising places; but when its mouth was only filled with wool and hair it was much displeased, cried vehemently, and gave up the attempt after two or three endeavours. On one occasion it got some wool into its throat, and Wallace was afraid it must be choked; but after a good deal of cough it threw it up, and he destroyed the mock mother and relinquished the last attempt to give the little creature some occupation.

At the end of a week Wallace began to feed the ape with a spoon. He mixed soaked biscuit with egg and sugar, and sometimes with sweet potatoes. It took this food readily, and made droll grimaces in order to express its satisfaction or displeasure with what was offered. The little being licked its lips, drew in its cheeks, and screwed up its eyes with an expression of extreme content when it had a mouthful of anything it particularly liked. On the other hand, when the food was not sufficiently sweet and savoury, the orang turned it about in its mouth for a moment, as if to taste it thoroughly, and then spat it out. If the same food was presented again, it screamed violently and threw its arms about like a passionate child.

Three weeks after Wallace obtained the young orang, a macaca (*Macacus cynomolgus*), likewise

young, was brought to him. The two animals became at once the best of friends, neither showing the least fear of the other. The small macaca had not the slightest scruple about sitting on the other's body, and even on its face. When Wallace fed the orang, the macaca sat by to pick up any morsels which dropped, and when the meal was over it licked off whatever remained on the orang's lips, and even tore open its mouth to see if anything remained there; then it lay down on the poor creature's body as if it were a comfortable cushion. The small, helpless orang endured all these insults with the most unexampled patience, only too glad to have something warm to cling to and encircle fondly with its arms. But it had its revenge, for when the other little ape wished to get away, the orang held on as long as possible to the movable skin of the back or head, or to its tail, so that it cost the macaca many violent struggles to escape.

Wallace carefully observed the different behaviour of these two animals, which were of nearly the same age. All the observations hitherto made show that very young anthropoids display a helplessness resembling that of children of about the same age, although other families of apes, in common with most young mammals, kittens, puppies, etc., early attain to greater activity and independence.

When Wallace had kept the orang for about a month, and placed it on the ground, its legs straggled outwards, or it overbalanced itself and fell heavily forwards. When lying in its box, it would hold on to the edge, and once or twice it fell out

in consequence. If allowed to be dirty or hungry, or otherwise neglected, it would cry loudly until it received attention, or sometimes would cough or struggle like an adult animal. If there was no one in the house, or if no one paid attention to its cries, it would be quiet for a time, and only renew them when a step was heard.

At the end of five weeks the two upper front teeth were cut, but throughout that period the creature had not grown, and remained of the same size and weight. This was doubtless owing to the want of milk or other nourishing food. Cocoa-milk seemed to produce diarrhœa, of which it was cured by castor-oil. A week or two later it sickened of what appeared to be intermittent fever, and died within a week.*

In 1837 the Zoological Gardens in London received an orang of two or three years old. He was for the most part sluggish and inert, but had occasional fits of better humour and playfulness. When angry he would attack strangers, but he generally sat cross-legged on a low stool, or on the ground before the fire, wrapped in a woollen rug. When the giraffes of the establishment inquisitively stretched their long necks over the bars of the ape's cage, the creature evinced no fear, but tried to seize the long-legged animals by the muzzle. This orang answered to his name, and was obedient to his keeper, often searching in his pocket for the dainties concealed there. He was uneasy when separated by the cage-bars from his master; and when confined in an enclo-

* Wallace's *Malay Archipelago*, vol. i.

sure of cane interwoven with wire, he bent the wire asunder and squeezed himself through the hole, so that the cage had to be made stronger. The creature presented an absurd appearance dressed in a jacket and breeches. When he desired any dainty that he saw, he looked alternately at it and his keeper, and protruded his lips like a snout. In drinking, this animal took the vessel in his hand, brought the rim to his lips, and then drank with an air of gravity. I may here observe that when anthropoids drink in this way, they generally take the vessel in one hand, and support it with the back of the fingers of the other.

When the orang we have just described was disappointed in his desire to obtain anything, he threw himself on the ground, howling and screaming until he got his own way. He sometimes had furious fits of passion, in one of which he tried to destroy the bars of his cage by hitting them with the stool. As he did not succeed in this attempt, he gave vent to his fury in a loud outcry, which only ceased on the return of his keeper.

An orang brought by Montgomery to Calcutta in 1827, was less phlegmatic than animals of this species usually are. He played with those who carried him when they stooped over him, caught them by the hair, and so on. He tried to scour his tin vessel with a cloth, throwing one end over his shoulder, as he had seen the servants of the house do. He was particularly fond of milk, tea, wine, and pandanos fruit. He was very inquisitive, and tried everything that he could reach, first with the fingers, then with the

lips, and finally with his teeth. He was fond of biting off the coat-lappets of his visitors. His absurd gestures, combined with his air of solemnity, excited laughter even in the grave natives. He was once drinking tea, when some one filled the empty mug with water; he emptied it out upon the floor, threw himself on his back, screamed, and struck his breast and belly with his hands. His gait was clumsy and unsteady when he tried to walk upright. When he went on all-fours, he sometimes supported himself on his hands and swung himself forward with his feet. If he lost his balance in walking upright, he fell upon his head, and then went on by turning somersaults. As soon as he was unchained, he went into the house and tried to get a portion of his master's breakfast. In spite of his usual inquisitiveness, he was not at all excited by the sight of his melancholy countenance in the glass.

The large orang which was in the Berlin Aquarium in 1876 was a sullen companion, and looked like an old Bedouin as he crouched down and peered from under the covering which was thrown over him. His keeper could only trust him when he brought him an orange, and if he approached the bars of the cage without food, the ape flew at him, gnashing his teeth. He was sluggish whenever he was not excited by hunger. Then he started from his usually sitting position, and devoured the food which was cautiously passed through the door. If kept waiting, he threw himself on his back in a rage. When his hunger was satisfied, he played with the straw, the cord, or with his blanket. When it was neces-

sary to change his straw, he was lured away by holding out an orange at the top of his pole, and the change was effected while the ape was tearing open the rind and sucking out its contents. In the evening he never omitted to clear out a hole in the straw, and to roll himself in his blanket. Gabriel Max has drawn a striking likeness of the resigned attitude of a sick orang.

Gibbons have often been observed in a state of captivity. Of the slothful and inanimate siamang there is nothing of much interest to report. The other species are, with few exceptions, phlegmatic, shy, and timid, but hardly ever averse from human society. Within a month Harlan was able to make a hulock so tame that he would hold on with one hand to him, while putting the others on the ground, and so walk about with his keeper. He came to his master's call, seating himself close to him on a chair, shared his breakfast, and took an egg or chicken-bone off the table so neatly as not to soil the cloth. He was fond of cooked rice, bread soaked in milk, bananas, oranges, coffee, tea, chocolate, milk, etc. Generally he only dipped his fingers in the drinking vessels and licked off the liquid, but he could drink in human fashion. He searched the house for spiders and other creeping things, and brushed away flying insects with his right hand. The creature was very affectionate, and when Harlan came to him in the morning, he greeted him with a joyful sound like a bark, which went on for about a minute. He came to a call even when at a distance, and was pleased to be combed,

brushed, and fondled. Two other hulocks taken by Harlan behaved in the same way.

The *Hylobates albimanus* of the Berlin Aquarium, which I have already mentioned, was, as described by Hermes, and also according to my own observations, a very peaceable creature, although, if compelled to do what he did not like, he sometimes tried to bite a little, especially when just taken from his warm bed. But as soon as he was taken by the hand or lifted up, his anger was appeased. Although much less lively than the chimpanzee which was his companion, and less inclined to play, he was pleased with children, and watchfully observed their movements. His dexterity was wonderful. He was almost always present at dinner and supper, when the table was covered with dishes, and he ran up and down it, in order to go from one person to another, without touching, still less upsetting, the smallest article. His food consisted chiefly of white bread, milk, sweet cocoa, fruit, and Kiel sprats, of which he was particularly fond, as well as of sweet grapes. Before taking any liquid, he cautiously touched it with his tongue, to ascertain that it was not too hot; then he drank it up, without taking the cup or vessel in his hand, as the chimpanzee did. He did not like cold or moist food, and would seldom touch a peeled pear, while willing to eat it from Herme's hand. Grapes were his favourite dainty, and if hungry when he saw them, he uttered a gentle noise which resembled the cry of a wood-pigeon. He often repeated this noise, *Hu, Hu,* to express pleasure, surprise, or curiosity,

or when the same sound was uttered by others; and it was in this way that he greeted Hermes when he came to his bed in the morning. He was happiest when seated on a woman's arm, with his long arms wound round her neck, and would sit quiet in this position as long as he was permitted to do so, and when taken away would scream like a child. When Frau Hermes left the room, he would run after her, and try to scramble up as soon as he reached her; if she took his hand, he went with her quietly. This gibbon may be compared favourably with other anthropoids, on account of his extraordinary cleanliness. He always returned to the place first used for his necessities, and never made his bed or the room unclean. There was not a trace of smell about him, so that he was quite an agreeable companion; and he shared the bed of one of Dr. Hermes' children without causing the least disturbance or discomfort. He was fond of swinging to and fro by a cord, to which he held with one hand.

A specimen of *Hylobates funereus* was kept in Paris for about a year. It was very intelligent, yet less so than other anthropoids. It knew its keepers and frequent visitors, and was pleased to be fondled; but it showed no preference for one person more than another, not even for its keeper.

Martin describes how in 1840, in Paris, a live bird was let into the cage of an *Hylobates agilis*. After watching its flight, the ape swung himself on to a distant bough, which he seized with one hand and the bird with the other. Its objects, both the bird and the bough, were attained with as much

certainty as if only one object had arrested its attention. He bit off the bird's head, plucked out the feathers, and then threw it away.

Another female specimen of *Hylobates agilis* suddenly attacked her keeper, sprang upon him, scratched him with hands and feet, and bit him on the breast, so that it was fortunate for the man that the creature had shortly before lost her canine teeth. It was said that the same ape had killed a man in Macao.

Anthropoids when kept in confinement suffer from caries of the teeth and jaws, from chronic and acute bronchial and intestinal catarrhs, from inflammation and consumption of the lungs, from inflammation of the liver, from pericardial dropsy, from parasites of the skin and intestines, etc. When ill, as we learn from many sources, these animals display much resemblance to men. Among others, Bock observed an aged male orang-utan in Sumatra, suffering from consumption, which lay nearly all day wrapped in a coverlet, and was constantly racked by a violent cough.*

On the skulls of wild gorillas and chimpanzees we find traces of caries of the teeth and jaws, by which, therefore, these animals may be affected in a state of nature, as well as by parasites on the skin and intestines.

* *Unter den Kannibalen auf Borneo*, p. 31.

CHAPTER VII.

POSITION OF ANTHROPOIDS IN THE ZOOLOGICAL SYSTEM.

THE racial history of apes can only be traced with any certainty up to the Miocene period. The fact of the contemporary existence of apes and pachydermata has been frequently asserted, but it is still too far from being established to merit further consideration here. Traces of the slender ape (*Semnopithecus*) have, however, been found in the Miocene of Greece, Wurtemburg, the mountains of Sewalik, and in the region bordering on the Himalayas. The name given to one of these fossil species (*Semnopithecus subhimalayanus*) seems to establish its locality. The numerous remains of *Mesopithecus Pentelici* in Attica have, however, given rise to controversy. Gaudry and Beyrich were disposed to assign these specimens exclusively to the slender ape, but Gaudry has since declared that, while the structure of the skull and teeth is that of *Semnopithecus*, the structure of the limbs is that of a macaca. He regards,

therefore, *Mesopithecus* as an interesting form of apes, and this is expressed by its scientific name.*

The separation of these two species of apes (*Semnopithecus* and *Macacus*) must, he considers, have occurred rather late. *Pliopithecus*, from the fresh-water marl, Sansan, is assigned by Gaudry and others to the gibbon. Lartet and Quenstedt believe, however, that it is nearer to the next neighbour on the south, the magot (*Inuus*), on account of the five fangs of its last tooth. Köllner thinks the connection with *Semnopithecus* not improbable.

Dryopithecus Fontanii, of which I have already spoken, seems, as I judge from a cast taken by Fric in Prague, to be of an expressly anthropoid character; but the scantiness of the materials do not allow us to form any precise conclusions as to the zoological position of this extinct animal. The structure of the back teeth, as we have already said, is certainly anthropoidal. Quenstedt, always cautious in his judgments, is of opinion that the ape's teeth found in the ironstone of the Suabian Alps in the secondary mammal formation, are of a decidedly anthropoid character, and the animals to which they belonged must therefore have been of the same type. Fossil remains of the African stumpy ape (*Colobus*) have also been found at Steinheim.† *Macacus priscus* of the valley of the Arno seems to be allied with the African macaca.‡ Owen's

* *Enchainements*, p. 235.

† Fraas, *Wurtembergische Jahresheft*, xxvi. plate iv. fig. 1 : 1870.

‡ Forsyth, *Atti della Societá Italiana di Scienze Naturali*, xiv. : 1872.

Macacus pliocenus from Essex is closely related to *Macacus sinicus.* Fossil apes have also been observed in America. *Protopithecus* was a very large animal, related to *Mycetes.* Another fossil species, found in South America (*Laopithecus*), must have been closely related to man. This latter fact is the more remarkable, since it has generally been assumed, and indeed with reason, that there is a marked division between the apes of the Old and New Worlds.

The species now found in tropical America of the silky apes (*Hapale*), the Sahui (*Jacchus*), the leaping apes (*Callithrix*), the bellowing apes (*Mycetes*), and the rolling apes (*Cebus*), were already represented in the diluvial period of that continent. It does not appear that any extensive generic diffusion of apes has taken place since that period. It is otherwise with the development of species, which seems, at any rate to a partial extent, to have occurred late. This may be inferred from the physical characteristics of gorillas and chimpanzees, which, with all their differences, have much in common with each other. In the fourth chapter we have described forms of apes lying between the gorilla and the chimpanzee, and it seems possible that these are a reversion to one or the other form. The numerous varieties of form among anthropoids point to a continuance of the process of severance in this family of apes, and little more than an isolating influence is needed to produce the gradual conversion of varieties into constant species.

On account of their external bodily character-

istics, of their anatomical structure, and their highly developed intelligence, anthropoids not only stand first among apes, but they take a still higher place, approximating to the human species. In accordance with what I have said in the second and third chapters, I set aside the order of the *Quadrumana*, and accept the Linnæan order of the *Primates*, both for men and apes. I would include men as *Erecti* with anthropoids as *Anthropomorpha* in a sub-family of the *Primarii*. In the case of apes (*Simiina*) I should retain the convenient distinction between those with a narrow and those with a wide nasal aperture (*Catarrhina* and *Platyrrhina*). The semi-apes (*Prosimii*) should constitute a separate order of mammals. The following systematic scheme shows the classification I suggest:—

I. MAMMALS (*Mammalia*).

A. *Monodelphia*, Blainv. (*Placentalia*, Owen).

I. Order: *Primates*, Linnæus.
 1. Family: *Primarii*.
  (1) Sub-family: *Erecti* (*Homo sapiens*).
  (2) Sub-family: *Anthropomorpha*, Linnæus.
   (*a*) *Dasypoga, i.e.* Anthropomorpha, without the sessor callosities.
    (α) Genus: *Troglodytes*, E. Geoffroy.
     Species: The gorilla (*Troglodytes Gorilla*, Savage and Wyman). The chimpanzee (*Tr. niger*, E. Geoffroy).
     The other species are not accurately known.
    (β) Genus: *Pithecus*, E. Geoffroy.
     Species: Orang-utan (*Pithecus Satyrus*, E. Geoffroy).
   (*b*) *Tylopoga, i.e.* Anthropomorpha, with sessor callosities.
    (γ) Genus: *Hylobates*, Illig.
     Species: see p. 45.

(2) Family: Apes proper (Simiina).
(1) Sub-family: Catarrhina.
Genera: Semnopithecus, Colobus, Cercopithecus, Innus, Macacus, Cynocephalus.
(2) Sub-family: Platyrrhina.
Genera: Mycetes, Lagothrix, Ateles, Cebus, Pithecia, Nyctipithecus, Callithrix, Chrysothrix, Hapale.

Chapter VIII.

A summary, together with some further considerations of the anthropomorphism of the gorilla, chimpanzee, orang, and gibbon.

Huxley's statement, that the lowest apes are further removed from the higest apes than the latter are from men, is, according to my experience, still perfectly valid. It cannot be denied that the highest order of the animal world is closely connected with the highest created being.

In the third chapter I have sought to show in what way the pithecoid characteristics of men may be proved. From the latter chapters, also, much may be learned with respect to the anthropoid characteristics of anthropoids. The external form first provokes the comparison. There is much in the bodily structure which spans the apparent chasm between men and apes, and this is evedient to the simplest understanding. The head, and the general form of the body, especially in young male and female gorillas, chimpanzees, and orangs, and even in gibbons, if we exclude the length of their

arms, display many points of resemblance with man. It is shown even in separate organs of the body—as, for instance, in the ear. The illustrations given in the second chapter of the ears of apes, including that of the gorilla, were intentionally taken by me from such specimens as had least resemblance to man, and yet even in these a certain likeness must be recognized.

I have already observed that the old males of an anthropoid species are always further removed from man than the young, and this is especially the case with the gorilla. The head of an aged male gorilla, with its great cranial crests and powerful jaw, displays striking differences from the human type. This is an important fact, since in the case of man we almost without exception regard the fully developed male adult as the typical form.

In considering the limbs, the differences between the arms and hands of man and those of anthropoids are apparent, but less striking than in the case of the lower limbs. For the prehensile foot of apes has in it something abnormal which distinctly differs from the human foot, adapted for walking. Nor can the prehensibility of the human toes in certain cases be directly compared with the prehensibility of an ape's foot, in which the great toe has the action of a thumb. Haeckel remarks that newly born children can also take a strong grip with the great toe, and if a spoon is inserted they can hold it with the foot as firmly as with the hand.* This power is, however, only partial and subordinate, compared with the

* *Anthropogenie*, p. 482: Leipzig, 1874.

manifold and developed prehensibility of an anthropoid's foot. The possibility of walking upright to a certain, although sometimes to a very limited, extent is no exclusive privilege of anthropoids, since this power may be acquired by training in the case of other apes, as well as of dogs, pigs, horses, etc. Many apes of the New World, such as the tailed and climbing apes, as well as some semi-apes, bears, ichneumons, scaled and rodent animals, can go for some distance in an upright position, quite as readily as anthropoids, and without being trained to do so.* The structure of anthropoids is, indeed, better adapted for going on all-fours, or for climbing. The projection of the coccyx in the form of a rudimentary tail has, as is well known, been observed in some isolated cases in the human species. This peculiarity is supposed to be hereditary in the case of some non-European peoples, such as the Niam-Niam of Central Africa, and some of the Southern Malays. But this surmise has not yet been confirmed.

It has already been said that when we compare men and anthropoids, the profile of the coloured man presents a striking likeness to that of anthropoids. This is believed by the coloured people themselves, who, especially among negro races, regard the large apes as accursed individuals of their own species, as dumb and hairy men, and so on. It should, however, be noticed that anthropomorphism plays an important part in the religious life of rude peoples, and that it is comparatively easy for uncivilized men to place themselves on the same level as animals, while civilized

* We do not here include the leaping and running mice.

races reject such ideas with self-conscious pride. I may add that civilized men are revolted by the proverbial ugliness of apes, and therefore reject with abhorrence any admission of actual relationship with them. We must, however, remember that men are by no means generally endowed with physical beauty, and especially with beauty of feature. Among all nations we find individuals whose ugliness is little inferior to that of anthropoids, and which sometimes even exceeds it. A claim to a widely diffused physical beauty may be made by the peoples of classical antiquity; by the Teutonic, Roumanian, and Slav races; by the Circassians, Armenians, Tartars, Turks, Senites, Berbers, Bedja; and by some of the Indians, Polynesians, American Indians, and negroes: but such attractions are rare among other peoples of the world, such as the Mongols, the majority of negroes, Papuans, Guaranis, and Malays. We have already shown that among some of the lower races it is impossible not to recognize a purely external and physical approximation to the simian type.

Some men, again, altogether on psychical grounds, shrink from admitting any relationship between men and apes, since the mental organization of the former seems to them to be allied by no connecting-link with the anthropoids of which they think so meanly. Yet it should not be forgotten that the modes of living in degraded races differ little from those of anthropoids. I may here refer to what I have said of the Australian aborigines, whose brutal instincts demand our whole attention when we undertake such comparisons. A horde of Boto-

cudos, mentioned by the intelligent observer Prince Maximilian of Neuwied,* and a village on the upper Yupurá, inhabited by the Mirenhas, and described by Martius,† left upon the travellers a grisly impression of their brutal degradation. This impression might be further strengthened if we could inspect a hutted encampment of the Obongo or the Doko.

It has been observed that the rudest savage is in a condition to show pity and loyalty to his own fellows. Thus, for example, in the winter of 1881–82, when some Fuegians were exhibited in Europe, one of them fell sick, and was cared for by his savage companions with affection, and even with a certain appearance of tenderness. But, as we have seen, anthropoids take care of and defend the members of their family in the same way, and display mutual dependence and loyalty; this has been especially noticed in the case of several orang-utans which have tended each other. Love for their young, and not rarely love for their mates expressed in the strongest manner, is, speaking comparatively, deeply rooted in the animal world. It is well known that both rude and civilized peoples are capable of showing unspeakable, and as it is erroneously termed, inhuman cruelty towards each other. These acts of cruelty, murder, and rapine are often the result of the inexorable logic of national characteristics, and are unhappily truly human, since nothing like them can be traced in

* *Reise nach Brasilien*, ii. 177: Frankfurt-am-Main, 1821.

† *Beiträge zur Ethnographie und Sprachenkunde Amerikas*, etc., i. 534: Leipzig, 1867.

the animal world. It would, for instance, be a grave mistake to compare a tiger with a bloodthirsty executioner of the Reign of Terror, since the former only satisfies his natural appetite in preying on other mammals. The atrocities of the trials for witchcraft, the indiscriminate slaughter committed by the negroes on the coast of Guinea, the sacrifice of human victims made by the Khonds, the dismemberment of living men by the Battas, find no parallel in the habits of animals in their savage state. And such a comparison is, above all, impossible in the case of anthropoids, which display no hostility towards men or other animals unless they are first attacked. In this respect the anthropoid ape stands on a higher plane than many men.

A great chasm between man and anthropoids is constituted, as I believe, by the fact that the human race is capable of education, and is able to acquire the highest mental culture, while the most intelligent anthropoid can only receive a certain mechanical training. And even to this training a limit is set by the surly temper displayed by anthropoids as they get older. They are interesting subjects of study in the menagerie, but they never become, like our ordinary domestic animals, useful members of the household economy. I myself hold that all human races are capable of culture, while differing in the degree to which it is possible for them to attain. I do not, for example, suppose that a tribe of Queensland Australians can be so educated as to be placed on a level with the highest intellects of our own nation. But how many ages

it has taken to raise us so far above the Papuans! It is indeed manifest that even very rude savages may be constituted serviceable members of human society, as we may see from the changes which have taken place among the Sandwich Islanders, the Tahitians, and the Maoris in the course of the last eighty years. In our days the envoys of the Queen of Madagascar have understood how to move in the highest Berlin circles with high-bred demeanour, and we must recognize this fact as significant, without, however, deluding ourselves by too wide deductions from it.

The remark has often been made that the African blacks, Indians, etc., display great docility when young, and are very receptive of wisdom and culture, but stop short at a certain point, as if unable to advance beyond it, and sometimes, indeed, like apes in advancing age, relapse into their originally savage state. It may, however, be inferred that these attempts to educate young savages are generally wrecked by mistaken methods of instruction. The young sons of nature are often too much indulged, their childish performances are over-estimated, their minds are over-taxed, the due development of mind and body is checked; they become arrogant, and then people are surprised that, as self-consciousness increases in their immature brains, a greater or less amount of conceit is developed. There are cases in which a savage, who has been with much labour educated and civilized, relapses into barbarism, and comes to a violent end as the enemy of his former protector, as a robber or a

rebel; yet, even to the end of his life, he has developed qualities and conditions which recall to him better times. We see an example of this in some of the civilized Maoris who afterwards joined the revolted tribes, and who introduced among their countrymen the strength of a firmer organization against the English supremacy. The bearing of these relapsed savages always has in it something higher than we can trace in the savage obstinacy of a morose old chimpanzee or orang.

Nor have the attempts to educate savages been uniformly unsuccessful. The great Indian chief Tekumseh; the presidents Benito Juarez, and Ramon Castilla; the negro Toussaint l'Ouverture; the Hova king, Radama I.; the Polynesian rulers, Kamehameha II., Pomare I., Georges, and Kokabau, show what may be made of such materials under favourable circumstances. The poor Indian from Oaxaca; the steadfast leader Perus, who belonged to a needy Arriero family; the Haytian who was formerly driver on a plantation, are as far removed from aboriginal savages as the Malagasy and Polynesians educated by European missionaries.

It is well known that nations, in the earliest periods of their existence, have to pass through certain rude conditions of their development, and the most highly civilized nations are not exempt from this law. The transition period of the Stone Age is necessary for all, and with the use of metals a higher and more cultivated life has been gradually developed. Even for those who do not recognize any sharp line of demarcation between the stone

and metal periods, yet, speaking generally, they will admit that the times in which stone instruments, and those in which bronze and iron instruments were chiefly used, present tokens of actual epochs in historical culture. As we know, there are also certain phases of development in the Stone Age. In its earliest stages the rudely shaped and unworked tool could not procure for its owner any regular shelter: he lived in caves, clefts, or under a scanty covering of leaves, and made use of his tool in killing wild animals; in cutting wood; in preparing skins, tendons, and gourd-vessels; in dismembering the prey obtained in hunting; and in extracting marrow from bones. With the art of shaping and sharpening these stone tools, a progressive improvement in the conditions of human life went hand in hand.

We can picture to ourselves the physical and psychical conditions of the first and earliest men of the Stone Age as those of extremely rude savages, but who were endowed with the gift of working out for themselves higher conditions of life.

In the year 1868 Colonel Laussedat, of the Berlin Academy of Sciences, exhibited the lower jaw of a rhinoceros, found in the Miocene at Billy, Allier, in which there was a notch which must, in the opinion of many naturalists, have been made by the hand of man. The Abbé Delaunay found in the Miocene of Pouancé, Maine-et-Loire, the rib of a Halitherium, which was notched, and which likewise appeared to have been subjected to human manipulation. Garrigou is of opinion that certain bones found at

Sansan were broken by the hand of man, and Dücker expressed a similar belief about the fossils of Pikermi. These ideas have been strongly opposed. Many of the marks on these bones have been represented to bear traces of the teeth of carnivora, rodents, etc. The Abbé Bourgeois found flints in the Miocene of Thenay, near Pont-Levoy, Loir-et-Cher, of which he ascribes the working to beings of a higher intelligence than the animals of that period. This opinion is shared by eminent anthropologists, such as Vibraye, Worsaae, Mortillet, de Quatrefages, and Hamy. Gaudry does not doubt the accuracy of the account given of their position at Thenay, by so experienced a geologist as Bourgeois. The illustrious observer of the quaternary epoch is only concerned with the question whether these flints at Thenay were artificially worked or not. The stones were found in a layer of the same kind of rubble. When a number of such flints are placed together, only a few people can discover an incontestible distinction between the artificially shaped and the unshaped stones. The alleged presence of shaped flints in the Miocene Age still demands careful examination. The epoch of the Middle Miocene is very ancient, and Léberon distinguishes between fauna found in the limestone of Beauce and Faluns and those of the Upper Miocene, of Eppelsheim and Pikermi. According to this author, the next in succession was the Lower Pliocene of Montpellier; then the Pliocene of Perrier, Solilhac, and Coupet. Next came the fauna of the forest bed at Cromer, and then those of the

boulder clay. To judge from the Norfolk strata, these latter were of very long duration. Above the fauna of the boulder clay are those of the diluvium, followed by the fauna of the reindeer period and of our own time.

Whatever may be thought of the many changes which have taken place, whether they are regarded as the result of distinct and independent creations or as the result of transformations, no geologist can doubt that an immense tract of time was required for the production of these forms. In the Middle Miocene there is not a single species of mammal which corresponds to any of our extant species. If we start from the standpoint of simple palæontology, it would be difficult to assume that the being which shaped the flints at Thenay can have remained unaltered in the midst of all these changes. If, as Gaudry remarks, it can be shown that the flints collected by Bourgeois in the Beauce limestone were really artificially shaped, he as a geologist would not hesitate to recognize in the *Dryopithecus* the author of this handiwork.*

But, speaking provisionally, the *Dryopithecus* which is assumed to have used these flints, and of which we, unfortunately, know only the little which can be gleaned from a few fragments of bone, must remain the object of an interesting hypothesis, so far as his advanced anthropomorphism is concerned. No anthropoid now in existence has shown itself capable of adapting stones, etc., to his personal use. Moreover, the most fanatical advocates of the doctrine of

* *Les Enchainements du monde animal*, p. 240.

descent are becoming ever more convinced that man cannot be the issue of any extant form of anthropoids. It is true that a close, and in many respects a very close, physical connection may be traced between men and anthropoids, but not the possibility of a direct descent from the one to the other. This is especially shown from the physical development of the larger apes, which only strongly resemble men in their youthful stages, and lose this character more and more as they grow older. The absolute deficiency of any capacity for the further development of the intellectual qualities of our modern species of anthropoids is another proof of this fact; their intelligence is, indeed, higher than that of other mammals, and also of other apes, but they are still far behind the intelligence of man, which is capable of still further development.

In the process of physical growth, as I feel myself compelled often to repeat, anthropoids constantly diverge further from the human organization. C. Vogt justly observes: "When we consider the principles of the modern theory of evolution, as it is applied to the history of development, we are met by the important fact that in every respect the young ape stands nearer to the human child than the adult ape does to the adult man. The original differences between the young creatures of both types are much slighter than in their adult condition: this assertion, made long since in my lectures on the human race, has received a striking confirmation from recent autopsies of young anthropoids which have died in the Zoological Gardens of Europe. In

proportion to the age of the specimen, the characteristic differences in the form of the jaw, the cranial ridges, etc., become more evident. Both man and apes are developed from an embryonic condition, and from the period of childhood in a diverging or almost opposite direction into the final type of their species, yet even adult apes still retain in their whole organization features which correspond to those of the human child." * Quenstedt also says: "However much *Homo sapiens* is raised by his intelligence above all other animals, however important the physical differences are which divide him from apes, yet the scene of their existence in the world is by no means so wide that, as time goes on, the narrow limits between them may not approximate more closely." †

In these words the opinion I have already expressed is set forth, an opinion which continues to gain ground; namely, that man cannot have descended from any of the fossil species which have hitherto come to our notice, nor yet from any of the species of apes now extant. It is more probable "that both types have been produced from a common ground-form, which is still more strongly expressed in the structure of young specimens, because the age of childhood is less advanced" (Vogt).

This supposed progenitor of our race is necessarily completely hypothetical, and all the attempts hitherto made to construct even a doubtful repre-

* *Die Säugethiere in Wort und Bild*, p. 49.

† *Handbuch der Petrefactenkunde*, 3rd edit., i. 38 : Tübingen, 1882.

sentation of its characteristics are based upon the trifling play of fancy.

Darwin came to the conclusion that man has, at any rate, descended from a highly organized form. He goes on to say:

"The grounds upon which this conclusion rests will never be shaken, for the close similarity between man and the lower animals in embryonic development, as well as in innumerable points of structure and constitution, both of high and of the most trifling importance, the rudiments which he retains, and the abnormal reversions to which he is occasionally liable—are facts which cannot be disputed. They have long been known, but until recently they told us nothing with respect to the origin of man. Now, when viewed by the light of our knowledge of the whole organic world, their meaning is unmistakable. The great principle of evolution stands up clear and firm, when these groups of facts are considered in connection with others, such as the mutual affinities of the members of the same group, their geographical distribution in past and present times, and their geological succession. It is incredible that all these facts should speak falsely. He who is not content to look, like a savage, on the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation. He will be forced to admit that the close resemblance of the embryo of man to that, for instance, of a dog; the construction of his skull, limbs, and whole frame, independently of the uses to which the parts

may be put, on the same plan with that of other mammals; the occasional reappearance of various structures—for instance, of several distinct muscles, which man does not normally possess, but which are common to the Quadrumana; and a crowd of analogous facts;—all point in the plainest manner to the conclusion that man is the co-descendant with the other mammals of a common progenitor." *

"The most ancient progenitors in the kingdom of the vertebrata," observes the same great English naturalist in another place, "at which we are able to obtain an obscure glance, apparently consisted of a group of marine animals, resembling the larvæ of existing Ascidians. These animals probably gave rise to a group of fishes as lowly organized as the lancelet; and from these the Ganoids, and other fishes like the Lepidosiren, must have been developed. From such fish a very small advance would carry us on to the amphibians. We have seen that birds and reptiles were once intimately connected together; and the Monotremata now, in a slight degree, connect mammals with reptiles. But no one can at present say by what line of descent the three higher and related classes, namely, mammals, birds, and reptiles, were derived from either of the two lower vertebrate classes, namely, amphibians and fishes. In the class of mammals, the steps are not difficult to conceive which led from the ancient Monotremata to the ancient Marsupials; and from these to the early progenitors of the placental mammals. We may thus ascend to the

Darwin's *Descent of Man*, 1st edit., vol. ii. p. 385.

Lemuridæ, and the interval is not wide from these to the Simiadæ. The Simiadæ then branched off into two great stems, the New World and Old World monkeys; and from the latter, at a remote period, Man, the wonder and glory of the universe, proceeded." *

Setting aside for the present this long pedigree of man, let us consider some of the isolated phases which have been established in the still incomplete condition of modern science. As far as semi-apes are concerned, whose near relation to men and apes has of late been strongly urged, I agree with those who, like Vogt, consider that their order, with its variety of forms, points to a complex origin, probably from marsupial animals, with which their organization presents many common features; hence it appears that some of their forms belong to the earliest Tertiary mammals with which we are well acquainted. "In conclusion," he writes, "it appears, from these facts, that any very close connection between the semi-apes and apes, and hence with man, cannot be proved. With the exception of the opposing thumb, which is and was a widely diffused characteristic common to many species, the semi-apes have not a single anatomical feature in common with apes. Their jaw, the most permanent characteristic, places them in the insectivorous class; to enroll them among the ancestors of man is to set at nought all the principles of scientific research." †

That purely hypothetical being, the common

* Darwin's *Descent of Man*, i. p. 212.

† *Die Säugethiere in Wort und Bild*, p. 67.

ancestor of man and apes, is still to be found, and this is the task assigned to palæontology. Whether this science, to which a great future belongs, will ever accomplish the task, is a question which concerns itself. Meanwhile, considering the great palæontological achievements of our day, the discovery of the *Odontornithes, Ætosauri, Rhamphorynchi, Holoptychia*, etc., we need not despair of the possibility of discovering the true link between the world of man and mammals. This purely speculative side of research, this purely scientific mode of treating the descent of man, is no longer satisfied with unproved assertions, but will rather trust to the strenuous labour of future times, and this need not disturb any religious or political convictions. Even if the assumed ancestral type should really be discovered in some geological stratum, yet research will have to overcome immense difficulties, if it is to explain the development of the understanding and of speech, and the growth of independent human intelligence. Yet we must not, on this account, refuse to recognize the possibility of achieving some new discoveries in this direction. To do so would be to stifle the impulse to scientific research, and this would be unworthy of our former intellectual achievements. Let us therefore labour on with courage.

In matters which concern ethnology we are constantly shown that even those races of men which are very remote from each other, and of whom it cannot be supposed that they were in earlier times united in one nation, have made the same technical

discoveries, and have adopted similar manners and customs and similar religious observances. This allows us to infer that there is a physical and psychical unity of human nature which indeed separates into races and varieties, but not into distinct species. Certain tokens of what is hypothetically the primeval type will predominate even in the progeny which has been modified by a distinct and separate development, and we need not be surprised by reversions to the animal structure, even in man, the ultimate scope of organic development. Nor will the developed culture of man offer any hindrance to such reversions. The theromorphic conditions which we have pointed out in the third chapter of this work, such as the frontal process of the squamous temporal portion, the transverse enlargement of the occipital bone, the pointed ear, etc., occur both in the higher and lower races of man; just as, for example, both in primitive and high-bred races of horses there are reversions to fossil forms in hind toes, cloven hoofs, etc.

Not only the physical, but the mental development of man advances uniformly, and not *per saltum*. Physical qualities and defects may occur in a given number of negroes and Papuans, and may be absent in an equal number of Europeans, and conversely may occur in the one and be absent in the other; yet, in their mental condition, negroes and Papuans must always be regarded as in a lower order than Europeans. And if physical superiority is more widely diffused in European peoples than elsewhere, owing to higher culture, less exposure, and better

nourishment, a more regular mode of life, and often also to the sexual selection prompted by æsthetic considerations, yet the reversion to such animal characteristics as do not exercise any modifying influence on the bodily development of the individual, occurs both in these and other races. I conclude these remarks with the reproduction of the fine passage with which Darwin ends his work on the descent of man.

"Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hopes for a still higher destiny in the distant future. But we are not here concerned with hopes or fears, only with the truth, as far as our reason allows us to discover it. I have given the evidence to the best of my ability: and we must acknowledge, as it seems to me, that man, with all his noble qualities; with sympathy which feels for the most debased; with benevolence which extends not only to other men, but to the humblest living creature; with his god-like intellect, which has penetrated into the movements and constitution of the solar system;—with all these exalted powers, man still bears in his bodily frame the indelible stamp of his lowly origin."

APPENDIX.

IT was after I had finished this treatise that Mohnike's *Blicke auf das Pflanzen-und Thierleben in den indischen Malaienländern* (Münster, 1883) came into my hands. The author, who was for several years physician and medical superintendent in the Dutch Indies, has given an interesting account of the orang-utan. It appears that this animal is only found in the northern part of Sumatra, and is more common on the western than on the eastern coast. Even there the orang is only occasionally captured. The Dyaks of Borneo are fond of the flesh of this ape, which they shoot, especially in the interior of the island, with poisoned darts, projected from a blow-pipe. The wounded part is then carefully cut out.

Mohnike states that in Borneo *Hylobates concolor* is called Ouo-ouo by the Malays, and Kalawet by the Dyaks. Dark specimens of *Hylobates variegatus* are in the Malay dialect called *itam*, or black Unko, and light specimens are called *puti*, or white Unko. A good illustration of *Hylobates leucogenys* is given in the *Proceedings of the Zoological Society*, p. 680, Plate 42: London, 1877.

It should be added to what I have said in the text,

that the uvula of the orang-utan is often absent (Bischoff, *Beiträge zur Anatomie des Gorilla*, p. 37; and Rückart, *Der Pharynx als Sprach-und Schluck-apparat*, p. 24, plate iii. fig. 10: Munich, 1882. I have, however, examined a specimen in which the uvula was quite perceptible, as well as the palate and arched root of the tongue.

In addition to the lower jaw from Naulette, of which I have spoken above, the fragment of a lower jaw has lately been found in the Schipka cave, Moravia, declared by Schaaffhausen to be that of an ape-like child. Virchow has carefully examined this fragment, and considers that it belongs to an adult of the mammoth age, who suffered from retention of the teeth, and that there is nothing pithecoid about it. The same author subjected the Naulette jaw, which he has repeatedly examined in Brussels, to a close analysis, and is somewhat disposed to admit the pithecoid character of this specimen (*Zeitschrift für Ethnologie*, p. 277: 1882).

R. Baume, on the other hand, considers that both the Naulette jaw and that from the Schipka cave are pithecoid forms. He finds in these two specimens the actual proof of the existence of man-apes in the diluvial period, since they differ widely, in the form of the lower jaw, from any living specimens. This author is of opinion that in the diluvial period there must have been races of men far inferior to the lowest races now in existence (*Die Kieferfragmente von La Naulette und aus der Schipkahöhle*, Leipzig, 1883).

See Hartmann, *Sitzungsbericht der Gesellschaft naturforschender Freunde zu Berlin*, November 19, 1878, for remarks on the tendon, the blood-vessels of the shoulder and thigh in anthropoids, in addition to those given in the text.

AUTHORITIES FOR CHAPTER I.

(1) "Hinc (*i.e.* Θεῶν ὄχημα) tridui navigatione torrentes igneos prætervecti in sinum venimus, qui Noti Ceras dicitur (Νότου Κέρας). In sinus recessu insula erat priori, illi similis; nam lacum habebat, in quo insula erat altera, referta hominibus silvestribus. Erant autem multo plures mulieres hirsutis corporibus, quas interpretes Gorillas (Γορίλλας) vocabant. Nos persequentes viros quidem capere non potuimus, omnes enim effugiebant quum per præcipitia scanderent et saxis se defenderent; sed feminas cepimus tres, quæ mordentes et lacerantes ductores sequi nolebant. Atque occidimus eas et pelles detractas asportavimus Carthaginem. Neque enim ulterius navigavimus, quum annona deficeret" (Hannonis Carthaginiensis Periplus. Geographi Græci Minores, ed. C. Muelleri, vol. i.).

(2) Comp. Temminck, Esquisses zoologiques sur la côte de Guinée (Leiden, 1853), p. 3.

(3) Marc. de Serres first directed the attention of naturalists to this mosaic. Comp. Froriep, Notizen zur Natur-und Heilkunde, book 42. It has been frequently said that the original of this mosaic is in the Museum of Antiquities at Berlin. Undoubtedly the mosaic in question also consists of a landscape with hippopotami, crocodile, etc., but it cannot be compared with that of

Palestrina, which is to my knowledge in the Barberini palace at Rome.

(4) See the Natural History of the younger Pliny, ii. 172; vii. 2.

(5) Regnum Congo: hoc est Vera Descriptio Regni Africani quod tam ab incolis quam Lusitanis Congus appellatur, per Philippum Pigafettam, olim ex Edoardo Lopez acromatis lingua Italica excerpta, nunc Latio sermone donata ab Aug. Cassiod. Reinio. Iconibus et imaginibus rerum memorabilium quasi vivis, opera et industria Joan. Theod. et Joan. Israelis de Bry, fratrum exornata (Francofurti, MDXCVIII.).

(6) Abhandlungen der Königl. Bayrischen Akademie der Wissenschaften (iii. cl. ix. div. 1).

(7) A voyage to Congo and several other countries in Southern Africa, Church collection of voyages and travels (London, 1744), i. 651.

(8) Relation d'un voyage fait en 1695–97 aux côtes d'Afrique, etc. (Paris, 1699).

(9) Nouveau voyage en Guinée, p. 74.

(10) Observationes Medicæ (Amsterdam), § 56. I have recently had occasion to doubt whether Tulpe's representation of an ape is not founded on that of an orang-utan of average size. At any rate, the head of the animal given by this anatomist reminds me more of an orang than of a chimpanzee.

(11) The Anatomy of a Pygmy, compared with that of a Monkey, an Ape, and a Man. With an Essay concerning the Pygmies, etc., of the Ancients (edit. i., London, 1699; edit. ii., 1751).

(12) Purchas, His Pilgrims. I have made use of the edition published in London in 1625 (vol. ii. 982).

(13) Beschryvinge des Afrikaensche gewesten van Egypten, Barbaryen, Lybien, Biledulgerid, Negrosland, Ethiopien, Abyssinie, etc. (Amsterdam, 1688; edit. ii. 1679). I have made use of the German version of 1760.

(14) The name Quojas Morrou is also used by Tulpe. A living specimen of these animals was given by Dapper to Prince Frederick Henry of Orange, and is perhaps the one described by Tulpe.

(15) Mission from Cape Coast Castle to Ashanti (London, 1819: trans. Weimar, 1820; Vienna, 1826). I have made use of the latter translation.

(16) Trans. of the Zoolog. Soc., vol. iii., 1848: On a new species of Chimpanzee, by Professor Owen.

(17) A description of the external characters and habits of Troglodytes Gorilla, by Ph. S. Savage, and of the osteology of the same, by Jeffreys Wyman (Journal of Nat. Hist., Boston, 1847, vol. v.).

(18) Th. Savage: Notice of Troglodytes Gorilla, a new species of Orang on the Gaboon (Boston, 1847). Comp. Kneeland in Proc. of the Boston Soc. of Nat. Hist., 1850, 1852.

(19) Ostéographie (Paris, 1839–64). Atlas, vol. iv., Mammifères, plate i.

(20) Archives du Muséum d'Histoire Naturelle de Paris, vol. x.

(21) Ibid., vol. viii.

(22) An impression on steel: A mode of photographic illustration used by Nièpce de St. Victor, which has since been materially improved.

(23) Der Gorilla, etc. A coloured illustration by G. Mützel, plate i.

(24) Adventures and explorations in Equatorial Africa (London, 1861). A journey to Ashango Land (London, 1867). The country of the Dwarfs (London, 1872).

(25) Reade, Savage Life: being the narrative of a tour in Equatorial, South-Western, and North-Western Africa, etc. (London, 1863). Brehm, Thierleben, edit. i., i. 16. See also Hartmann, Der Gorilla, p. 4.

(26) Observations on Du Chaillu's papers on the

new species of mammals discovered by him in Equatorial Africa: Proceed. of the Zool. Soc., London, 1861.

(27) Proceed. of the Boston Soc. of Nat. Hist., 1860. See also Du Chaillu's Adventures and Explorations, chap. 22; and Reichenbach's Vollständigste Naturgeschichte der Affen (Dresden and Leipzig), p. 196.

(28) Description of cranium of an adult male gorilla from the River Danger, indicative of a variety of the great chimpanzee (Troglod. Gorilla): Trans. of Zoolog. Soc., London, vol. iv., 1853. Memoir on the Gorilla (London, 1865): well illustrated. Odontography (London, 1840–45). Article on Teeth, by Todd and Bowman, in the Cyclopedia of Anatomy and Physiology, vol. iv. part ii. Lectures on the comparative anatomy and physiology of Vertebrata (London, 1866–68, vol. iii.).

(29) Burton's Two Trips to the Gorilla land, and the cataracts of the Nile (London, 1876).

(30) Compiègne's L'Afrique Equatoriale (Paris, 1875; Gabonais, p. 260).

(31) De Brazza's Le Tour du Monde, Année 1878, No. 936.

(32) Lenz's Skizzen aus Westafrika (Berlin, 1878), p. 171.

(33) Die Loango Expedition, pt. ii., by Falkenstein, p. 149.

(34) Koppenfels' Die Gartenlaube (1877), No. 25.

(35) Zoologiska Studier, Andra Häftet. (Lund, 1857).

(36) Revue d'Anthropologie (1876), p. 1, etc.

(37) The Medical Times, 1872.

(38) Descrizione di una scimmia antropomorfa proveniente dall' Africa centrale, in den Annali del Museo Civico di Genova, i. 53.

(39) Studii craniologici sui Cimpanzé. Ibid., iii. 3.

(40) Proceedings of the Academy of Nat. Sciences (Philadelphia, 1879), pt. iii. p. 385.

(41) On the Appendicular Skeleton of the Primates: Philosophical Transactions (1867), 299.

(41A) Macalister's Muscular Anatomy of the Gorilla: Proceedings of the Royal Irish Academy of Science, 2nd series, vol. i.

(42) Ueber die Schädelform des Menschen und der Affen, Leipzig, 1867.

(43) Die Hand und der Fuss. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft, vol. v.

(44) Archiv. für Anthropologie, viii. 67.

(45) Abhandl. aus dem Gebiete der Naturwissenschaften, herausgeg. vom Naturwis. Verein zu Hamburg-Altona (Hamburg, 1876), pp. 74–83.

(46) Ibid., p. 84, etc.

(47) Die anthropomorphen Affen des lübecker Museums (Lübeck, 1876).

(48) Mittheilungen aus dem königl. Zoolog. Museum zu Dresden (1877), No. 2, p. 225.

(49) Der Gorilla, mit Berücksichtigung des Unterschiedes zwischen Menschen und Affen, etc. Denkschrift des Offenbacher Vereins für Naturkunde (Offenbach, 1863).

(50) Ueber die Verschiedenheit in der Schädelbildung des Gorilla, Chimpanse und Orang-utan, etc. (München, 1867). Vergleichende anatomische Untersuchungen über die äussern weiblichen Geschlechts-und Begattungsorgane des Menschen und der Affen. Abhandl. der königl. bayrischen Akad. d. Wissensch., cl. ii. vol. xiii. plate ii. Beiträge zur Anatomie des Gorilla. Ibid. cl. ii. vol. xiii. plate iii.

(51) Beiträge zur Kenntniss des Gorilla und Chimpanse. Abhandl. der K. Gesellsch. der Wissensch. Göttingen, vol. 28.

(52) Ueber den Schädel des jungen Gorilla. Monatsberichte der königl. Akademie der Wissensch. zu Berlin (June 7, 1880), p. 516.

(53) Studien aus dem Gebiete der Naturwissensch., plate ii. (Petersburg, 1876), v. 235.

(54) Various works on the gorilla under the following titles:—Beiträge zur Kenntniss der sogen. anthropomorphen Affen, Zeitschrift für Ethnologie, series iv. 198; viii. 129; ix. 117. Ueber das Hüftgelenk der anthropoiden Affen. Sitzungsber. der Gesellsch. Naturforsch. Freunde zu Berlin, April 17, 1877. Ueber den Torus occipitalis transversus am Hinterhauptbeine des Menschen; Ibid., Nov. 26, 1880. Die menschenähnlichen Affen, No. 247 of the Sammlung gemeinverständlicher wissensch. Vorträge, by Virchow and Holtzendorff, p. 11.

(55) Vogt's Vorlesungen über den Menschen (Giessen, 1863).

(56) L'homme et les singes. Bulletin de la Société d'Anthropologie, vol. iv. series ii., 1870.

(57) Magitot, Bulletin de la Soc. d'Ethnographie de Paris, 1872.

(58) Gesammelte Werke. A. d. Engl. von J. V. Carus, v. 1, 2 (Stuttgart, 1875).

(59) Gervais's Hist. Nat. des Mammifères (Paris, 1854), vol. i. p. 27.

(60) Huxley's Manual of the Anatomy of Vertebrated Animals (London, 1871).

(61) Flower's Introduction to the Osteology of the Mammalia (London, 1870).

(62) Giebel's Odontographie. Vergleichende Darstellung des Zahnsystems der lebenden und fossilen Wirbelthiere (Leipzig, 1855).

(63) Proceed. of the Zoolog. Soc. (London, 1876).

(64) Hist. Nat. générale et particulière, vol. 35 (Paris).

(65) I quote here the passage which Bosman has taken from the foregoing work by Buffon: "Les singes que l'on appelle smitten (forgerons) en flamand, sont de couleur fauve, et deviennent extrêmement grands:

j'en ai vu un de mes propres yeux qui avait cinq pieds de haut et de bien moins grand que l'homme. Ils sont méchants et très forts ; un marchand m'a conté, que dans le voisinage du fort de Wimba, le pays est occupé par un très-grand nombre de ces singes, qui sont de force à attaquer l'homme, ce dont on citait des exemples." Bosman goes on to speak of another species of ape in the same district, which is as hideous as those of the larger kind (Beschrijving van Guiné (1737), p. 34; Voyage de Guinée, p. 258).

(66) Comp. on this point Huxley's very lucid remarks in his work on the position of man in nature.

(67) Le Jardin des Plantes, by Bernard, Couailhac, Gervais and Lemaout (Paris, 1842), i. 82.

(68) Ibid., p. 83, together with the illustration.

(69) Copied by Chenu, Encycl. d'Hist. Nat. Quadrumanes (Paris, 1851), plate i. fig. 36. By Gervais, Hist. Nat. des Mammifères (Paris, 1854), i. 16, 22. By A. B. Reichenbach, Praktische Naturgesch. des Menschen und der Säugethiere (New edit., Leipzig), plate i. fig. 4. H. G. L. Reichenbach, Die Vollständigste Naturgesch. der Affen (Dresden and Leipzig), plate xxxiv., fig. 466; etc.

(70) J. B. Brehm's Thierleben (Leipzig, 1876), i. 46, 68.

(71) Hartmann, Der Gorilla, etc. Woodcuts, Nos. vi., vii., viii., xiii.

(72) Beobachtungen an zwei lebenden Chimpanse, by H. Tiedemann, Philadelphia. Nach brieflichen Mittheilungen bearbeitet by L. Bischoff (Bonn, 1879).

(73) Temminck's Esquisse Zoologique, pt. i., etc.

(74) Vrolik, Recherches d'anatomie comparée sur le Chimpanse (Amsterdam, 1841).

(75) On the muscles and nerves of a Chimpanzee, etc. (Journal of Anatomy and Physiology, series ii. 1871, p. 176).

(76) Brühl, Myologisches über die Extremitäten des Chimpanse (Wiener Medicin. Wochenschrift. Jahrg. 1817).

(77) Ontleedkundige nasporingen over de hersenen van den Chimpanse (Amsterdam, 1849).

(78) Des caractères anatomiques des grands singes pseudo-anthropomorphes, Archives du Muséum, vol. viii. Vergleichung der Anatomie des Gorilla mit derjenigen des Chimpanse: very well illustrated.

(79) Recherches sur l'anatomie du Troglodytes Aubryi (Nouvelles Archives du Muséum d'Histoire Naturelle. Mémoires, vol. ii.).

(80) Mittheilungen aus dem königl. Zoologischen Museum zu Dresden, No. 2 (Dresden, 1877).

(81) Comp. the works cited in note 54. Also Hartmann, Beiträge zur Zoologischen und Zootomischen Kenntniss der sogenannten anthropomorphen Affen. Archiv. für Anatomie, Physiologie, etc., by Reichert and Du Bois-Reymond. Series for the years 1872–76, with many plates, some of them chromo-lithographs.

(82) Description de l'espèce de singe aussi singulier que très rare, nommé Orang-Outang, de l'isle de Borneo. Apporté vivant dans la ménagerie de M. le Prince d'Orange. Description d'un recueil exquis d'animaux rares, etc. (Amsterdam, 1804). The plates, representing the orang, which accompany this work are not badly done.

(83) Verhandelingen van het Bataviaasch Genootschap. Tweede Deel. (Derde Druk, 1826).

84. Beschrijving van der groote Borneosche Orang-outang of de Oostindische Pongo. Ibid. Also Briefe des Herrn v. Wurmb und des Herrn Baron v. Wollzogen (Gotha, 1794).

(85) General and particular descriptions of the vertebrated animals; order quadrumana (London, 1831): with coloured plates.

(86) Monographies de Mammalogie, vol. ii.

(87) Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche besittingen (1839–45). Zoologie, p. 1.

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(90) Calcutta Government Gazette, Jan. 13, 1853. Asiatic Researches, xv. 489, 491.

(91) Wallace's Malay Archipelago.

(92) Naturgeschichte des Orang-Utan und einiger anderer Affenarten. Herbell (Düsseldorf, 1791).

(93) On the Comparative Osteology of the Orang-utan and Chimpanzee: London and Edinburgh Philosoph. Magazine, vi. 457; x. 259. Trans. of the Zoolog. Soc. of London, i. pt. iv.

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(97) Note sur les métamorphoses du crâne de l'Orang-Outang, Bulletins de l'Académie de Bruxelles (1838). Annales des Sciences Naturelles (1839), p. 56.

(98) Zur Kenntniss des Orangkopfes und der Orangarten (Wien, 1856).

(99) Die Muskulatur der Extremitäten als Grundlage einer vergleichend-myologischen Untersuchung.

(100) L. s. c., Fig. 42, plate vii.

(101) L. s. c., plate i. p. 30 (left figure).

(102) Zeitschrift für Ethnologie (1876), vol. 15. Brehm's Thierleben, i. 83.

(103) Copied in Cassell's Natural History, i. 8 (52), with the erroneous title, "Sick Chimpanzee."

(104) Naturhistorische Früchte der ersten kais. russischen Erdumsegelung (Petersburg, 1813), p. 130.

(105) Le règne animal (nouv. edit.), i. 88.

(106) Is. Geoff. Saint-Hilaire et F. Cuvier, Hist. Nat. des mammifères (Paris, 1819–35), plate iii. fig. 4.

(107) Wanderings in New South Wales (London, 1834), vol. ii. chap. viii.

(108) Man and Monkeys (London, 1840), p. 423.

(109) Boston Journal of Nat. Hist., i.

(110) See work cited in note 83.

(111) See work cited in note 63, p. 140.

(112) Hist. Nat. des Singes (Paris, an. ix.), p. 154

(113) Archives du Muséum d'Hist. Nat., v. 529.

(114) Blyth in Journal of the Asiatic Soc., 1846, xv. 172; Ibid., 1847, xvi. 730.

(115) Proceed. of the Zoolog. Soc. of London, xiv. 11.

(116) Beiträge zur Anatomie des *Hylobates leuciscus.* From the Proceedings of the Bavarian Academy of Science, 2nd series, vol. x. plate iii.

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